Mineral Resource Team 2010 Activities Summary

Task Force for Business and Stability Operations

January 29, 2011

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Executive Summary

The Task Force for Business and Stability Operations was formed by the U.S. Department of Defense in 2006 to leverage American and international economic power as a strategic tool for promoting economic stabilization. Since then, the Task Force's mission has been to reduce violence, enhance stability, and restore economic normalcy in areas where unrest and insurgency have created a synchronous downward spiral of economic hardship and violence.

The Task Force initiates every new program and project with the assumption that the absence of a viable economic base is one of the primary factors which has historically led to state failure. When starting operations in Afghanistan in 2009, the Task Force began by asking the question: *What are the indigenous resources the Afghan people can use to create such a viable economic base, thereby ensuring Afghan economic sovereignty?*

With a nominal gross domestic product of just over $10 billion, much attributed to foreign assistance, Afghanistan needs industries that produce sustainable wealth, create jobs, and reduce the country's overreliance on international donors to fund its treasury and armed services.

In the summer of 2009, the Task Force assessed many critical sectors of the Afghan economy. One of the Task Force assessment's key findings was that the untold mineral wealth lying beneath the ground in Afghanistan could provide the very foundation needed for modern, thriving communities above it.

Using the quantities of known and undiscovered resources in the United States Geological Survey's Preliminary Non-Fuel Mineral Report (Stevens et al, 2007), the Task Force calculated the gross in-place value of minerals in Afghanistan at more than $900 billion. By leveraging the power of the market—as opposed to simple foreign assistance—the Task Force works differently than many other international governmental and non-governmental organizations. One of its primary methodologies first identifies investment opportunities, then hosts private sector investors in the regions where the identified opportunities are located, and, finally, works to ensure transparent business transactions between the investors and the local community. In order to make this mineral opportunity into a revenue-generating capability for the Afghan government and a positive source of livelihood for Afghans, the Task Force worked in this same manner to accelerate the power of the international natural resource market in Afghanistan.

After the initial simple calculation of gross in-place dollar value, the Task Force recruited private-sector exploration geologists to join the United States Geological Survey and the Afghan Geological Survey to analyze 1970s and 1980s Soviet geological data and maps to identify and assess high priority areas for further exploration. The Task Force then coupled the troves of data collected by the USSR with cutting edge remote sensing work and on-the-ground sampling work, thereby creating the multi-dimensional construct required by international investors before entering an emerging market like Afghanistan.

The Task Force integrated three primary sources of data to complete these investment packages:

1. **Soviet-Era Geologic Maps**

The Soviet Union spent decades and untold millions sending some of its best and brightest geologists to survey Afghanistan. Many of the resulting reports existed only at the Afghan Geological Survey in single paper copies - and the majority of the documents had never been digitized or translated from Russian into English. The Task Force digitized and translated hundreds of these previously overlooked reports. This data allowed the Task Force team to leapfrog several traditional stages of mineral exploration. Instead of starting from scratch, the geologists could then use this data and deposit history to pinpoint areas of high potential for investors, providing incentives for, as well as lowering the risk of, investment.

The Task Force also reinterpreted some of this legacy data to reflect current global demands and market trends. For example, gold exploration during Soviet times was based on the economics of gold at about $35 per troy ounce. With the price now soaring above $1,000, investor appetite for risk and larger, lower grade deposits has increased. Rare earth elements were also not considered important by the Soviets whereas now they are a strategic resource, critical for high-tech consumer and industrial products like hybrid car batteries and mobile phones.

2. **Remote sensing techniques used by the scientific and private sector exploration communities.**

   Thanks to USGS's cutting-edge work in remote sensing technology—including hyperspectral, ASTER, and geophysics—more data is now available on the surficial geology of Afghanistan than for probably any other country in the world, including the United States. The Task Force commissioned private sector remote sensing experts to pour through this data on the hunt for new mineral rich zones in areas not previously studied by the Soviets. This high-tech data yields new areas of interest needing ground-sampling and other analysis, and will focus the Task Force's exploration activities in 2011.

3. **New ground samples**.

   The Task Force has teams of private sector exploration geologists, USGS geologists, and AGS teams collecting rock and water samples throughout the country. The purpose of these ground missions is to validate the Soviet data and update the findings with modern exploration and analysis techniques. Our "ground-truthing" and extensive review of previously unknown Soviet reports has also allowed the Task Force to more accurately quantify deposits about which little was previously known. The result is a clearer, more accurate and compelling assessment of Afghanistan's mineral resources and economic potential.

This overall strategy reduces risk for investors because they know the data is of the highest quality, from a reputable source, and complies with standards financial backers require. Through this effort, many of the deposits analyzed over the last year have turned out to be more compelling, more valuable, and more attractive to international investors. The following key findings are selected from among 27 total sites surveyed or analyzed across Afghanistan this year, each of which demonstrate economic potential for development as discussed in the report.

Selected 2010 Findings

- **Zarkashan (Ghazni Province)**
  When discovered by Soviet and Afghan geologists in the 1970s, the Zarkashan gold and copper porphyry deposit was thought to have minimal value based on the economics of the time. After conducting field missions, remote sensing, and additional analysis of Soviet data, Task Force mining experts now estimate this deposit to be worth up to $30 billion and could become one of Afghanistan's largest mining operations. With the right development partner, Zarkashan could begin small-scale open pit heap leach gold production in one to two years. Within five years, Zarkashan could have a large-scale open pit copper mine in production.

  A model for this type of development is the Collahuasi mine in Chile, which is now the world's third largest copper mine. In that deposit, a consortium led by industry heavyweights Anglo-American and Xstrata made an initial investment of $1.8 billion that will keep the mine operating for 50 years, providing stability and long term economic growth for the region. This type of investment could similarly revolutionize Afghanistan's Ghazni Province. While Afghanistan poses many challenges to an investor, Zarkashan is located in an area not nearly as remote or forbidding as Collahuasi, which is surrounded by the barren Atacama Desert at 4,800 meters (15,748 feet) above sea level in the Andes Mountains.

- **Lithium (Herat, Ghazni, Nimruz, and Farah provinces)**
  Afghanistan is uniquely positioned to become a world leader in the production of lithium. After field missions to five locations, Task Force geologists estimate the country has upwards of $60 billion worth of lithium in its many evaporite lakes. These resources also have tremendous advantage over both Chile and Bolivia due to higher evaporation rates that lead to faster and more efficient production. Small-scale lithium production could begin within one year with large-scale production two to four years later. Lithium production also produces fertilizer ingredients and salt products that could be used by local communities.

- **Khanneshin (Helmand Province)**
  Discovered in the 1970s by Soviet geologists, the Task Force estimates the ancient volcano of Khanneshin to hold more than $89 billion in minerals strategic for high tech and industrial industries. While rare earth elements and niobium were not a priority for Soviet geologists, today they are crucial to the development of steel alloys, lasers, and super magnets. The heavy rare earths in Khanneshin are found in few locations around the world, and currently 99 percent of the world's supply is solely produced in China. This deposit could represent a long term development opportunity for Helmand Province that would create jobs across the spectrum from low skilled laborers to chemists, physicists, and engineers.

- **North Aynak (Logar Province)**
  The recent $43 billion Aynak copper deposit award to China Metallurgical Group Corporation has gained much international attention. Thanks to on-the-ground sampling and remote sensing, Task Force geologists infer there could be an equal or larger copper deposit located north of the Chinese plot. Aynak North could begin as a small underground cobalt mine in one to two years that would then support the development of

a large-scale open pit copper mine within five years. The deposit is believed to be a sediment-hosted copper deposit, which is one of the world's major sources of copper and cobalt. Situated 30 km south of Kabul, North Aynak is strategically located to take advantage of future rail infrastructure planned for the region.

- **Dusar-Shaida (Herat Province)**
  In the 1970s, Soviet and Afghan geologists thought this copper deposit was scientifically interesting but not economically significant. Upon gaining access to additional Soviet data that calculates reserve estimates and then checking that data with sampling missions and modern geochemical assays, Task Force geologists now estimate the deposit could contain up to $29 billion in copper alone – far more than was previously supposed.

- **Balkhab (Balkh Province)**
  A new discovery, this high-grade copper deposit located in a stable area in the Balkh Province could become a significant mining operation in less than five years. Balkhab, which has been surveyed by the AGS under mentorship by Task Force geologists, appears to be a volcanogenetic massive sulfide deposit. This type of deposit supplies much of the world's gold, copper, lead, and zinc. The Lisheen Mine in Ireland is a possible model for the development of Balkhab. That underground lead and zinc deposit took less than five years of active work from discovery to production and now employs hundreds of skilled workers.

Even if only one of the aforementioned projects is successfully brought to production, the impact to Afghanistan's economy would drastically change life for the Afghan people. It is reasonable to assume both Zarkashan and North Aynak will attract upward of $1.8 billion in investment each, with construction employment rates at 12,000 to 20,000 people per mine and direct long term stable employment at the mine of roughly 6,000 people each. A medium-scale copper mine like Balkhab could attract $400 million in investment, 2,000 to 5,000 jobs during the construction phase, and direct long term employment of up to 1,200 people.

Each small scale operation—whether that be the initial phase of development of the gold and copper mines or each lithium production initiative—has potential to attract upwards of $20 million in investment within two to three years, construction employment of up to 400 Afghans, and direct long-term employment of more than 100 Afghans. If all potential lithium deposits are put into production, that economic activity could result in up to $1.2 billion in additional annual revenue for the government of Afghanistan. These figures alone do not account for those people employed by the related industries necessary—the lab technicians, sampling crews, truck drivers, and hospitality industry workers—to support the mining towns.

It is no longer a question whether or not Afghanistan will have a mining industry. The question that remains is what this industry will look like. We have the opportunity now to position Afghanistan so its people can benefit from its vast mineral assets. These crucial assets—so essential to Afghanistan's future—hold the promise of thousands of jobs for Afghans, many of whom have known only poverty and subsistence. The potential for long term employment and job growth in this transformational economic sector cannot be overstated and the potential benefits for foreign investors shares the same potential upside. Of equal importance are the ancillary benefits that Afghanistan's mineral sector will provide the economy. Royalties and fees paid to the government will not just pay for police and military personnel, they will lead directly to the construction of roads, schools, hospitals, and public facilities – the very bricks and mortar of a successful society.

Acknowledgements

The Task Force for Business and Stability Operations would like to extend its sincere gratitude to Minister of Mines Wahidullah Shahrani, ISAF Commanding General David Petraeus, Ambassador Karl Eikenberry, and President Hamid Karzai for their leadership, vision, and determination to help Afghanistan become an economically sovereign nation. We also thank all of their teams as well as our partners at the United States Geological Survey and the Afghan Geological Survey. While we remain optimistic about Afghanistan's ability to become a socially and environmentally responsible center for natural resource development, we are realistic that Afghanistan's journey will be a long-term endeavor that will require coordinated investments in infrastructure, transportation networks, and human capital. Through concerted and focused long term effort across the full spectrum of participants—from government leaders to private sector investors—Afghanistan can leverage its natural resource wealth into a tool of good for all its people.

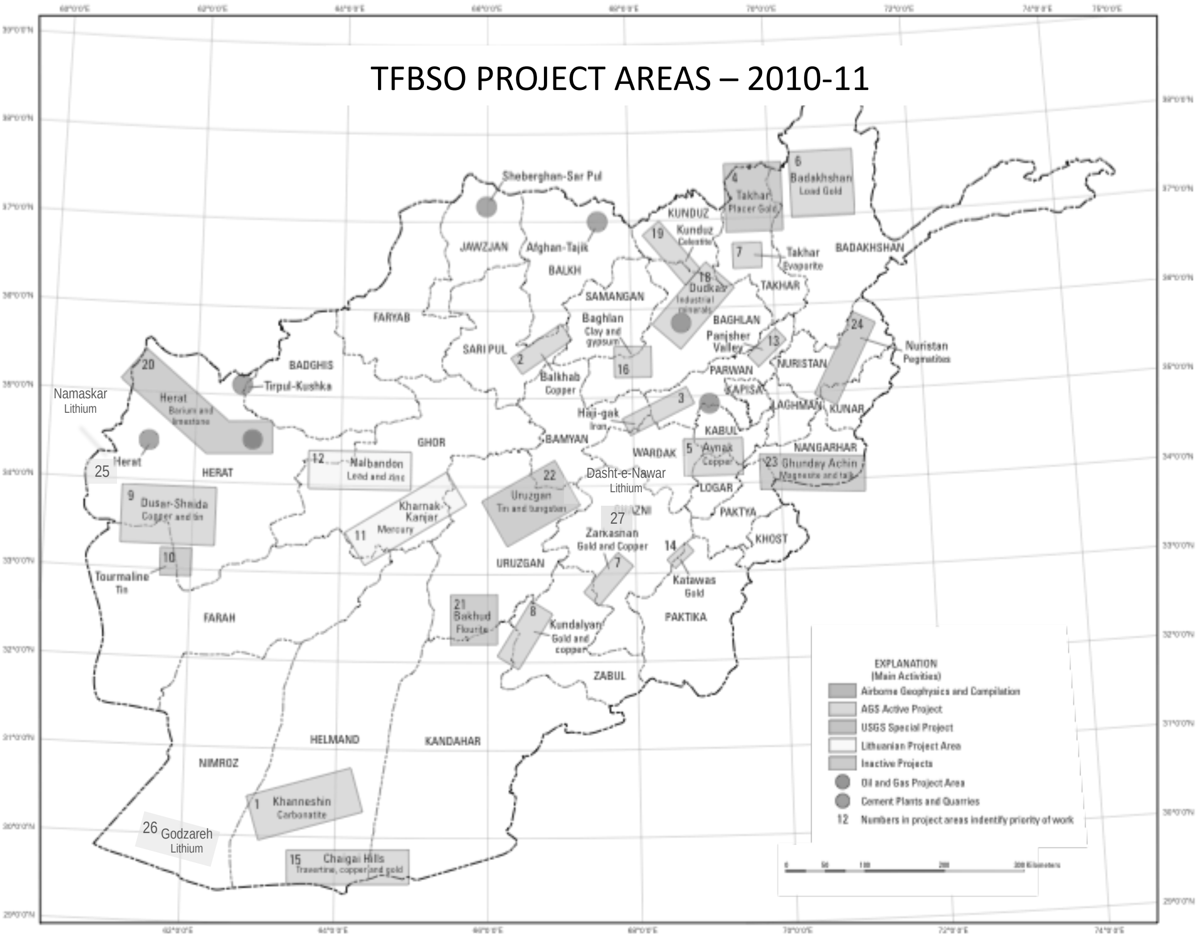

Figure 1: TFBSO Team Project Areas

Introduction

Afghanistan possesses some of the most complex and diverse geology on the planet. Located at the western end of the Himalayas where the Indian subcontinent collided with Eurasia, the country’s unique geological foundation created thousands of mineral occurrences. Afghans have always known their country contains vast riches; some of the world’s oldest known mines were established in Afghanistan to produce lapis lazuli for the Egyptian pharaohs. Aside from accidental discoveries by locals looking for gold and gemstones, most of what is under the ground remained a mystery until relatively recently.

USGS began work in Afghanistan in the 1950s, followed in the 1960s by counterparts at the British and German geological surveys. Beginning in the early 1970s, the former Soviet Union conducted the first truly thorough geological survey of the country in partnership with the Afghan Geological Survey. When the USSR left Afghanistan in 1989, their geologists left behind thousands of pages of surveys, drilling logs, and scientific studies on the country’s riches. The quality and quantity of these data demonstrate the abundant mineral resources distributed throughout the country.

USGS returned to Afghanistan with the support of USAID in 2004 to conduct two years of capacity building in the Ministry of Mines and assessment work collecting and processing legacy data. They also conducted regional geophysical and hyperspectral surveys. The Task Force program was built on this foundation by using that previously collected data to prioritize and identify areas with the highest potential for exploration and production and then by combining it with newly acquired data.

The purpose of this report is to present a preliminary compilation of data collected and synthesized by the Task Force since Fall 2009. While this review is not exhaustive, it presents a summary of information known prior to Task Force involvement in the project, an overview of present work, and a statement of current understanding of the commodities and deposit types throughout the country. This report also provides references to the archival reports of Russian, German, and British scientists recovered from the Afghan Geological Survey library by the Task Force and its Ministry of Mines and Afghan Geological Survey colleagues. These additional reports add depth and breadth to further understanding the geology of Afghanistan and, therefore, the potential mineral wealth of the country.

Task Force geologists, in conjunction with USGS and AGS, divided Afghanistan’s vast mineral wealth into 27 areas of interest (Figure 1). This calculation was based on security, scale, market value, infrastructure needs and availability, and time to impact. These areas of interest are each potential mining districts with one or more mineral deposits. The Task Force chose to focus on a balanced portfolio of minerals—both metallic and industrial—that could build a broad based mining industry in Afghanistan. By the end of 2010, Task Force geology teams had conducted ground surveys in 10 of the 27 areas of interest, resulting in objective, first-hand assessments of each area of interest.

A critical part of each team’s work included sampling of bedrock, soil, and water for geochemical assays and petrographic analysis. Other teams used remote sensing methodologies (Landsat, hyperspectral, ASTER, etc.) that provided a regional context to the analysis. While the particulars of each area of interest are not known with certainty, this extra sampling increased the general knowledge of deposit type and grade within each area. This sort of data is required by potential investors and regulators who need to know grade and size of prospective commodities. All data points are important for the financial and engineering models used to put a deposit on the path toward development and production.

To convey the scale of potential economic development, the Task Force took the known and undiscovered reserve and resource estimates provided in the 2007 Preliminary Non-Fuel Mineral Assessment and augmented them with resource estimates obtained through the 2010 field survey work by Task Force geologists to calculate a conservative estimate of the country’s mineral wealth. This calculation of gross in-place value was made using December 2009 prices for minerals and commodities sold on the London Metal Exchange and 2007 prices in the USGS Mineral Yearbook. The Mineral Yearbook lists production quantities and average prices for the two years prior to publication, but commodity prices are generally stable, so it was inferred that the 2007 average prices were a good estimate to predict 2010 prices. The numbers do not take into account infrastructure needs, production costs, taxation, or grade dilution. This table has been updated in Appendix 3 with January 2011 values for those metals on the London Metal Exchange and values from newly released Mineral Yearbooks, where available, for commodity minerals.

This report is intended to provide clarity into the methodology and findings of the natural resource work of the Task Force, so that the Government of the Islamic Republic of Afghanistan, and its people, will benefit economically from our work.

Lode Gold

Afghanistan's known gold resources total approximately 2.7 tonnes in both lode and placer deposits. USGS (2007) reports known estimates in Badakshan, Ghazni, and Zabul of 1,780 kg of lode gold and an additional 918 kg of placer deposits. These easily mined deposits could provide industry and employment at the artisanal to medium-sized levels.

However, most gold deposits in Afghanistan have neither been well studied nor classified because Soviet gold exploration was based on the economics of gold at roughly $35 per troy ounce. Even more so than lode and placer deposits, the large, low-grade porphyries and their gold content were not explored, mapped, or sampled thoroughly due to the fact that it was not profitable. Today, with gold soaring at more than $1,200 per troy, porphyries deposits not considered economically important 30 years ago are now extremely valuable.

<u>**Badakshan**</u>

Badakshan has the largest known gold deposits in Afghanistan, with a number of gold-quartz veins in the northern part of the province and many small placer deposits in valley streams. Both of these types of gold sources are well suited for artisanal gold mining which, subsequently, could be converted into larger development with infrastructure and exploration investments. To give a sense of the size of the resource, it is assumed the Takhar placer deposits in the west also derive from Badakshan gold.

As seen in the table below, the Ragh District deposits and prospects are significant and amenable to exploitation with artisanal operations and simple metallurgy. Out of all prospects, the Weka Dur/Bekadur deposit is known to have the best geometry for mining which allows a potential investor to quickly bring the mine to production and recoup a return on investment. The result would be a "medium-sized mine with significant future potential" (USGS 2010 Administrative Report to TFBSO).

Afghan Geological Survey Field Work Overview

The AGS began fieldwork in the Badakshan area in 2009. While they did not survey the Ragh subarea, known to be the center of Badakshan's large, lode gold deposits, the crews did continue work in Bahark Gold-Iron District and Fayz-Abad Gold District in the southeastern and southwestern areas of Badakshan, respectively. In addition to digging new trenches, the AGS crews also cleaned out existing trenches from earlier eras of exploration. By 2010, AGS had collected 391 samples from this part of Badakshan. These samples are currently being catalogued and will be analyzed by the USGS and a commercial laboratory by spring 2011.

Geochemical results from new trenching indicate small gold bodies may be present with economically significant concentrations at both subareas. Field observations and data indicate that occurrences in the areas may have characteristics similar to pluton-related gold deposits rather than the regional metamorphic deposits that are thought to make up deposits in the Ragh District (2010 USGS Administrative Report to TFBSO).

Current Understanding

There are three deposits in the Ragh subarea. The Bekadur (or Weka Dur) deposit was provided with C1 + C2 reserve estimates of 0.9583 tonnes of gold at an average gold content of 4.1 g/tonne. That reserve estimate of Bekadur alone is worth $34.9 million in gross-in-place value. In addition to gold, Bekadur is estimated to contain 46.7 g/tonne of silver.

Also in Ragh are the Cadar (or Kular) and Neshebdor prospects. As seen in the table below, both have significant gold showings that warrant additional work in 2011 if security and logistics concerns are first addressed.

Chilkoshar is estimated to contain about 40 quartz veins, four of which have commercial gold concentrations that average 12.3 to 84.9 g/tonne, totaling speculative resources of approximately 245 kg – worth approximately $8.9 million in gross in-place value.

Prospect	Gold (g/tonne)	C1 + C2 Reserves
Weka Dur	4.1	958.3 kg
Chilkorshar	12.3-84.9	245 kg
Cadar (Kular)	0.1-1.6	
Nesheb Dor	0.2-1.1	
Rishaw	5	
Shenghan	TBD	
Fumorah-Nakchir-Par	TBD	

Table 1. Badakshan Gold Deposits

In total, Chilkoshar and Weka Dur could be worth over $40 million – a significant resource for Northeast Afghanistan. The potential is high for additional deposits to be identified once detailed exploration begins. While the gold levels found by the AGS crews in the southern part of the district do not appear yet to be of significant economic value, their presence does support Soviet reports of high gold content in the Ragh District and other areas.

Copper and Gold Porphyries

Porphyry deposits are particularly important to Afghanistan's mining future as they often have easily mined gold deposits located with large copper resources. In the Preliminary Non-Fuel Mineral Resource Assessment, the USGS identified 12 permissive tracts for porphyry copper deposits, with an estimated average of eight undiscovered deposits throughout those tracts. These undiscovered deposits are estimated to contain:

- 28.4 million metric tonnes of copper
- 724,000 metric tonnes of molybdenum
- 682 metric tonnes of gold
- 9,100 metric tonnes of silver

In addition, the USGS calculated that skarn deposits contain approximately 70,000 metric tonnes of copper.

Part of the Task Force's mission natural resource work in 2010 focused on the Zarkashan and Kundalan porphyry copper and skarn deposits. Their locations in Ghazni and Zabul provinces, respectively, allow for significant job creation in particularly underserved and unstable areas. With the data already collected, Afghans could begin artisanal and small scale gold and copper mining, an indicator investors look for when evaluating larger opportunities.

Using the tonnage discussed in the USGS's Resource Assessment and current dollar prices, the in-ground value of metals in the Zarkashan-Kundalan tract could be worth as much as $36,555,558,000. With 3,279,000 tonnes of copper at $8,915.45 per tonne, the copper value

alone could be $29,233,858,920. With 80.44 tonnes of gold (2,586,206 troy ounces) at $1,405 per troy ounce at current rate, gold could be worth $3,633,619,430 in this tract. The 1,130 tonnes of silver could be worth $1,081,554,311 at a prices of $29.77 per troy ounce. Molybdenum could add significant value as well, $2,606,525,325, with 78,820 tonnes.

While these numbers are based on USGS's 2007 estimated undiscovered deposits, they pull from the known deposits and prospects in both areas of interest. Soviet and Afghan data also suggest these deposits have large potential for development.

Zarkashan

Both Soviet and Afghan geologists identified Zarkashan as having large potential for development. Ancient mines exist at Sufi Kademi and there are nearby shafts and the roads to support production at Zarkashan proper. The Soviet and Afghan geologists trenched, sampled, and drilled to varying degrees many of the target locations discussed in the following section. Summarized estimates on size and grade are included in the table below.

Most of the prospects identified by the Task Force for scoping missions are located along the southern margins of the Zarkashan pluton. These locations match up with hyperspectral anomalies and anomalous gold and copper samples from earlier Soviet and Afghan exploration as well as scoping missions conducted by the Task Force.

Previous Understanding

Zarkashan Target Area

The Zarkashan placer deposit is located in a 3,000 by 200 meter valley with 1.2 to 2.5 meter thick gold-bearing sedimentary rock layer near bedrock, with 1.5 to 11 meters of overburden. In USGS's estimation, "the gold bearing formation is 104,400 m^3 in size with an average 2 meter thickness and is 1,000 meter long," and resources calculated over the main part of the placer deposit at 116 kg gold, averaging 1.1g/m3 gold (Stevens, 2007). Some numbers indicate that Soviet geologists had conservative reserve estimates of 7.7 tonnes of gold, with "inferred reserves" of up to 15 tonnes of gold.

In addition to the Zarkashan gold placer, other bedrock copper and gold samples from prospect areas within the Zarkashan target area contain up to 70 grams of gold per tonne, along with significant copper mineralization.

Prospect Area	Gold (g/tonne)	Copper (wt %)	Notes
Zardak	1.2-19.4		
Khinjaktu	1.8	0.65-1.02	
Gulakhel	4.4		
Sufi Kademi	7		Ancient workings present
Dynamite	4-70		Drill holes present
Chah-i-Surkh	0.6-3.2		

Table 2. Zarkashan Gold Prospect Areas

Bolo Gold Area

The Bolo Gold Area refers to a number of gold-rich areas including Bolo gold, Belaw, and Utkul as well as other related gold-bearing occurrences. These and other areas are summarized in the table below, with gold grades, dimensions, and notes on the host rock or type of mineralized

zone. Additional detail on these and other prospect areas is available in the USGS Non-Fuel Minerals Assessment.

Prospect Area	Gold (g/tonne)	Copper (wt %)
Bolo Gold	0.8-34	
Alaghzar	0.1-35	0.1-3.1
Belaw	0.1-4	0.1-0.3
Lashkar-Qala	0.1-19.4 (avg 1.1)	2.4-3.5
Utkul	10-11	
Bala	0.8-34	
Anguray	0.3-142	
Bashargar	2.9-43	

Table 3. Bolo Gold Prospect Areas

Sampling Overview

In April 2010, the Task Force team conducted a sampling mission at six locations in Zarkashan District – three in the Zarkashan area and three in the Bolo Gold area. In the Zarkashan copper-gold area of interest, the team visited the Zardak, Zarkashan, and Dynamic copper-gold prospects. In the Bolo Gold area of interest, the team visited Bolo, Utkul, and Belaw gold prospects.

At all six sites, the purpose of the mission was to verify the locations for the prospect areas and collect hand and soil samples to verify the gold and copper content presented in the Soviet-era reports. A secondary purpose was to identify opportunities, key leader engagement requirements, and infrastructure requirements for further work in each area.

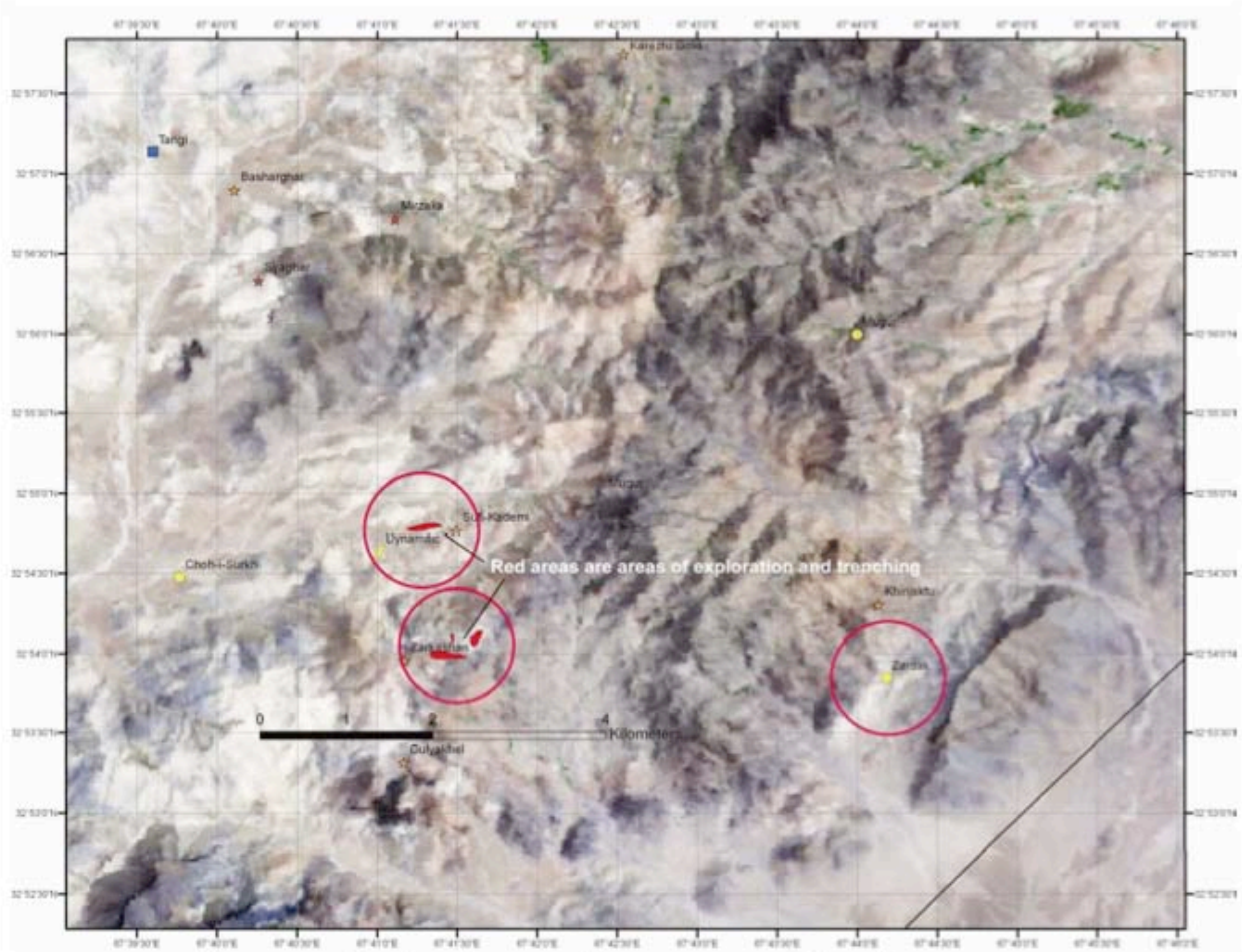

Figure 2: Zarkashan Gold Targets and Landing Areas

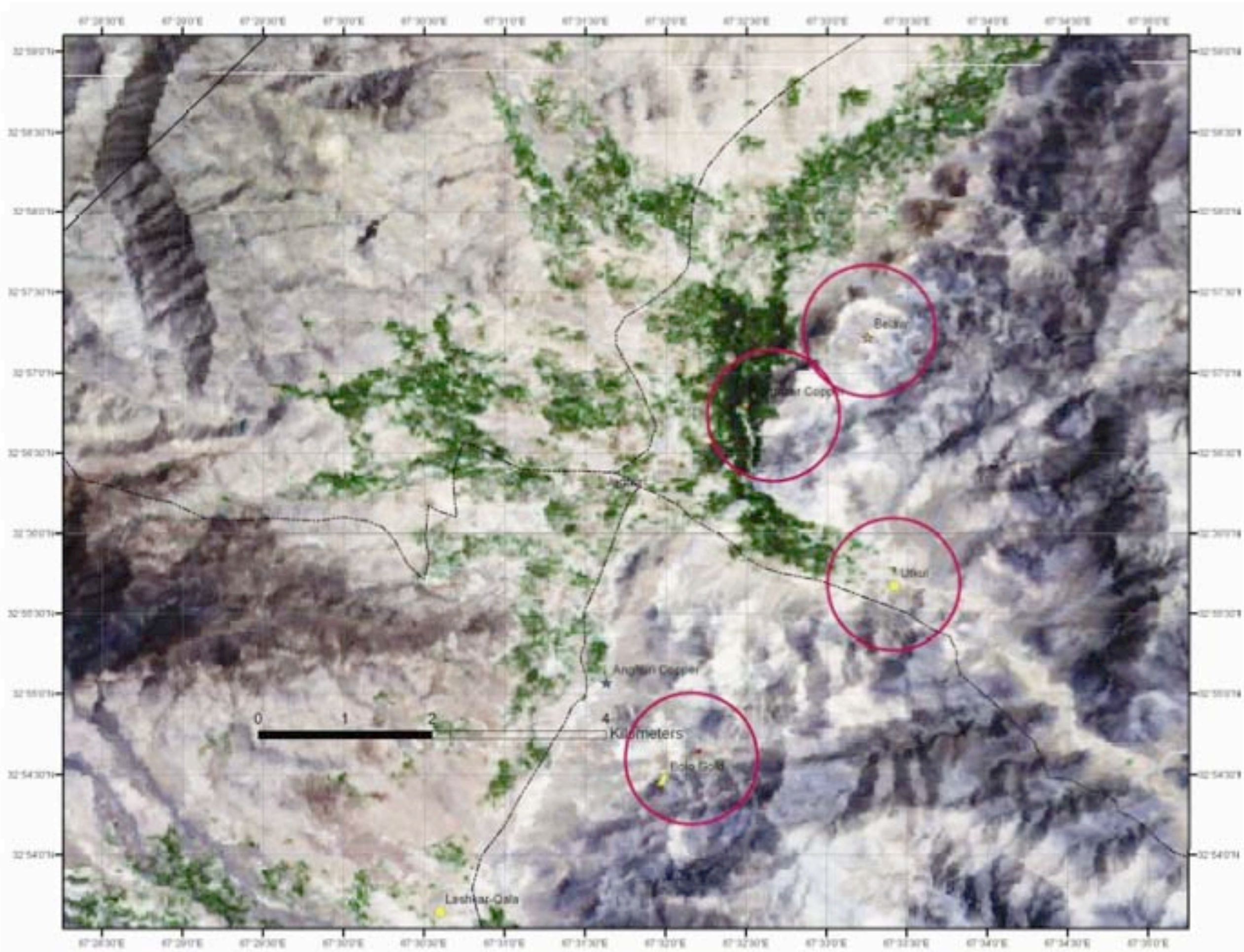

Figure 3: Bolo Gold Area Landing Sites

Field Notes from Scoping Mission

In April 2010 the Task Force team collected samples at the Zarkashan area of interest in Ghazni Province. Included in the team were USGS personnel, Task Force personnel, an ISAF military geologist, and US military team members. During the scoping mission, three sites in the Zarkashan area and three sites in the Bolo Gold area were visited:

- Zarkashan:
    - Zarkashan
    - Zardak
    - Dynamic/Dynamite
- Bolo Gold:
    - Bolo
    - Utkul
    - Belaw

Of the six sites, Zarkashan and Zardak were the most promising. Pre-existing exploration activity at Zarkashan was more extensive than expected and both sites had evidence of highly mineralized zones of copper and gold. These field observations are supported by the geochemical results explained below and both have gold content above the economic threshold.

Other unsampled areas remain promising, and field observations were helpful in clarifying the geologic setting and context. At Bolo and Utkul prospects, the team collected stream sediment samples. While the sample results are positive, they should be considered conservative and not representative due to the limited time available on site.

A key take-away from the field mission was that "large areas of hornfels and contact zones around the main intrusive may contain ore grade copper and gold and were not sampled or considered by the earlier Soviet workers."[1] The earlier exploration concentrated on small high-grade pods of skarn that would have been economic at 1970s gold and copper prices. The disseminated nature of the mineralization in large contact (hornfels) zones and the consistent mineralization throughout indicates large medium to low grade orebodies that are amenable to modern excavation methods at 2011 gold and copper prices.

Results from Zardak and Zarkashan are listed below with the highest gold results highlighted in yellow in Figure 3.

Area	Field Number	Additional Sample Attributes or Comments	Au ppb	% Au	kg/metric ton	g/metric ton	troy ounces/ metric ton
Zardak	ZA100001	malachite stained spotted hornfels	17,000	0.0017%	0.017	17	0.5466
	ZA100002	argillically altered didorite	14	0.0000%	0.000014	0.014	0.0005
	ZA100003	argillically-altered igneous breccia	41	0.0000%	0.000041	0.041	0.0013
	ZA100004	malachite-stained argillically-altered diorite	27,000	0.0027%	0.027	27	0.8681
	ZA100005	marble, grey	82	0.0000%	0.000082	0.082	0.0026
	ZA100006	malachite-stained hornfels	188,000	0.0188%	0.188	188	6.0443
	ZA100007	malachite-stained hornfels	17,000	0.0017%	0.017	17	0.5466
	ZA105001	limonite-stained marble	1,190	0.0001%	0.00119	1.19	0.0383
	ZA105002	limonite-stained marble	27	0.0000%	0.000027	0.027	0.0009
	ZA105003	limonite-stained marble	17	0.0000%	0.000017	0.017	0.0005
	ZA105004	limonite-stained diorite	45	0.0000%	0.000045	0.045	0.0014
	ZA105005	malachite-stained gossan-hornfels	10,000	0.0010%	0.01	10	0.3215
Zarkashan	ZR105001	slate and black mineral	680	0.0001%	0.00068	0.68	0.0219
	ZR105002	greissen pyrite/sericite	32,000	0.0032%	0.032	32	1.0288
	ZR105003	malachite stained hornfels	11,000	0.0011%	0.011	11	0.3537
	ZR105004	altered granodiorite	222	0.0000%	0.000222	0.222	0.0071
	ZR105005	malachite - stained hornfels	8,770	0.0009%	0.00877	8.77	0.2820
	ZR105006	malachite - stained granodiorite	10,000	0.0010%	0.01	10	0.3215
	ZR105007	hornfels - background	32	0.0000%	0.000032	0.032	0.0010
	ZR105008	hornfels - background	14	0.0000%	0.000014	0.014	0.0005
	ZR105009	skarn black and white breccia	1	0.0000%	0.000001	0.001	0.0000
	ZR105010	malachite stained hornfels	22,000	0.0022%	0.022	22	0.7073
	ZR105011	hornfels - background	32	0.0000%	0.000032	0.032	0.0010
	ZR100001	pyrhotite, sericite in hornfels	11,000	0.0011%	0.011	11	0.3537
	ZR100002	malachite-stained skarn	9,460	0.0009%	0.00946	9.46	0.3041
	ZR100003	slate and malachite and chacopyrite	1,770	0.0002%	0.00177	1.77	0.0569
	ZR100004	malachite-stained skarn and greissen	23,000	0.0023%	0.023	23	0.7395
	ZR100005	malachite and skarn/slate	182,000	0.0182%	0.182	182	5.8514
	ZR100006	black malachite-stained skarn	18,000	0.0018%	0.018	18	0.5787
	ZR100007	pyrite-rich sericite hornfels	6,800	0.0007%	0.0068	6.8	0.2186
	ZR100008	sericite-hornfels	6,400	0.0006%	0.0064	6.4	0.2058
	ZR100009	pyrite-rich skarn	70,000	0.0070%	0.07	70	2.2506
	ZR100010	oxidized ore and pyrite	8,490	0.0008%	0.00849	8.49	0.2730
	ZR100011	oxide ore	13,000	0.0013%	0.013	13	0.4180
	ZR100012	malachite-stained hornfels	35,000	0.0035%	0.035	35	1.1253
	ZR100013	maalchite-stained hornfels	88,000	0.0088%	0.088	88	2.8293
	ZR100014	fibrous hematite	533	0.0001%	0.000533	0.533	0.0171
	ZR100015	hornfels - background	19,000	0.0019%	0.019	19	0.6109
	ZR100016	malachite-stained hornfels	1,290	0.0001%	0.00129	1.29	0.0415
	ZR100017	pyrite-rich hornfels/skarn	11,000	0.0011%	0.011	11	0.3537
	ZR100018	malachite-stained hornfels	6,240	0.0006%	0.00624	6.24	0.2006

Figure 4: Gold results from Zardak and Zarkashan prospects. Highest results highlighted in yellow.

Scanning Electron Microscope Work

Scanning Electron Microscope and reflected light microscopic studies were conducted on thin sections of samples collected at the Zarkashan prospect. This technique allows geologists to look in very close detail at the grains of mineral that make up the rock under investigation. Using this technique, the team can learn about the percentage and textures of valuable minerals in the host rock, and, therefore, gain more information about the deposit as a whole.

[1] USGS Administrative Report: Summary of 2010 Activities

The samples from Zarkashan contain large grains of gold that are classified as "free gold". The large grain size of the mineralization has a significant impact on the economic feasibility of the deposit and serious implications for how that deposit may be mined. Free gold can be separated from the ores by gravity methods and can also be dissolved directly by other metallurgical methods rather than by after roasting.

Current Understanding
At Zardak and Zarkashan, results show gold content far above what is required for a deposit to be economic. Feedback from industry puts two ounces per tonne of ore to be the point at which an Afghan deposit is worthy of investment. Several locations have three times that content.

While additional work is required, the Task Force team confirmed the presence of copper and gold in economically significant concentrations. Additional work done by USGS, Sabins, and Ellis have identified anomalies suggesting extensive distribution of the mineralization, and a number of these may be medium to large-size outcroppings of "gold-rich copper orebodies". (USGS 2010 Administrative report to TFBSO)

Beyond increasing understanding of the size of the Zarkashan deposit, new data collected during 2010 has clarified the type of copper and gold mineralization present. The presence of "free gold" means that the deposit could be easily mined using the low-capital intensive and relatively low-skilled technique of heap leaching using cyanide. The simple metallurgy of the deposit means a short lead time on development and a short payback period on investment on a medium to large sized gold and copper ore.

Some numbers indicate the Soviets had conservative reserve estimates of 7.7 tonnes of gold, with "inferred reserves" of up to 15 tonnes of gold. At this conservative estimation, Zarkashan's gold reserves could be worth a gross in-place value upward of $547,600,000 without even considering copper or other base metals present.

Kundalan
The Kundalan deposit is a copper-gold porphyry deposit that falls in the same prospective regional USGS tract as the Zarkashan copper-gold deposit. The deposit is made up of 13 skarn beds, up to 12.5 meters thick by 158 meters long in some places. These skarn beds include ore minerals such as chalcocite, bornite, molybdenite, chalcopyrite, pyrite, sphalerite, and native copper.

The Soviet categories of C1 + C2 reserves for the Kundalan deposit were calculated from drilling and trenching data collected in the 1970s as:

- 21.4 thousand tonnes of copper (average copper content of the ore is 1.21%)
- 1.6 tonnes of gold (with the average gold content of 0.9 g/t)
- 133.4 tonnes of molybdenum (averaging 0.14% of the metal)
- Undetermined amount of silver (more than 10 grains to 10 g/t) and bismuth (up to 0.3%)

Within Kundalan, there are multiple prospects with copper, gold, and other base metals present that Soviet-era reports cite as having economic potential. Several of these areas, such as Garangh-Turga, are reported to haveancient workings, and most of the areas listed below have been previously trenched and/or sampled primarily by the Soviets.

The table below is an overview of the promising prospects within Kundalan, some of which were sampled by the Task Force team during the 2010 sampling season.

Prospect	Gold (g/tonne)	Copper (wt %)	Other (%)	Reserve Estimate
Hazarbuz	0.3-1.9	0.86-1.55		
Kundalan	0.5-2	0.62-1.2		13,000 tonne Cu 1.1 tonne Au
Kaptarghor	0.8-3.1	1.84-4.03	0.02-0.18 Mo	3,700 tonne Cu 282.3 kg Au 127.3 tonne Mo
Shela-i-Surkh	0.3-0.5	0.66-1.75	0.17 Mo	4,100 tonne Cu 154.5 kg Au 6.1 tonne Mo
Garangh-Turga	0.1-6.5	0.06-2.03	0.4-14.15 Pb 0.05-5.35 Zinc	
Garangh-Assanak	2.2	0.26	2.96 Pb 1 Zinc	
Garangh Outcrop	9.3-13.2			
Dorushak	1.1-33	0.83-7.68		
Kadalak	70	0.87	2.5 Pb 3.9 Zinc	
Kadalak-Argasu	2.7-127	0.03-9.41	0.06-0.96 Pb 0.27-0.55 Zinc	

Table 4. Kundalan Prospects

Using the same mineral prices from the table shared earlier in this report, the Kundalan reserve numbers present a conservative value for this deposit at over $206,000,000:

- 21,400 tonnes of copper = $143,380,000
- 1.6 tonnes of gold = $58,411,476
- 133.4 tonnes of molybdenum = $4,402,200

TOTAL $206,193,676

Field Sampling Activities
Sampling at Kundalan was performed to verify the locations and mineralization content presented in the Soviet era reports. The Task Force team visited three areas in April 2010:

- Garangh
- Kundalan
- Dorushak

The samples collected supported Soviet claims of large resources of gold and copper, and the trenches and mines were found as described by the Soviet and Afghan geologists in legacy reports. The geologic setting was also confirmed, further strengthening the estimates of the Soviets.

A key new observation was that the east and west parts of the orebody and prospect are covered by extensive colluvium. Therefore, much of the deposit has yet to be explored and it could be larger than currently estimated if there is continuity between mineralized orebody areas beneath

the colluvium cover. For this reason, airborne geophysics is especially important for further exploration work.

Current Understanding
Kundalan remains an area of special interest. The identified prospects are target areas for commercial-grade ores, however, with much of the deposit covered by colluvium, additional work is required. The substantial cover is consistent with the anticipated large size of the deposit that is indicated by aeromagnetic data.

The combination of known resources and strong aeromagnetic data results mean that Kundalan could begin as a small to medium-sized gold opportunity. Additional geophysics will tell if it could be much larger. The district is highly prospective for both cold and copper and it likely represents a large porphyry-copper mineralized system.

Based on this new data, the reserve calculations put forward by the Soviets are conservative and there is high potential for much higher resource value and mining development at Kundalan.

Dusar-Shaida

The Dusar-Shaida copper deposit, located in the southern part of Herat Province, holds an estimated 4.34 million tonnes of copper and an undetermined amount of molybdenum and gold (Peters et al. 2007). If that estimate is correct, the prospect is worth approximately $29 billion in copper alone.

There is debate regarding the origins of the Dusar-Shaida deposits. In the Preliminary Non-Fuel Minerals Assessment, Peters indicates that Shaida is likely a volcanogenic massive sulfide (VMS) deposit while Dusar is potentially a porphyry deposit. In the 1970s, Soviet and Afghan geologists estimated a resource of 4.8 million tonnes of ore grading 1.1 wt % copper and 1.2 wt. % zinc at just Shaida (Tarasenko and others, 1973; Abdullah and others, 1977).

Known mineralization at the Shaida porphyry deposit is 100 m long, 3 to 8 m thick with 0.01 to 0.30 wt. % copper as well as lead, zinc, tin, molybdenum, and arsenic. Soviet era exploration resulted in significant trenching and sampling at Dusar-Shaida, with more prominent workings in the Shaida portion. Trenching is visible from the air and from several imaging programs, such as Google Earth.

Field Activities to Date
In August 2010, the mineral assessment team visited three sites at Shaida and two at Dusar. A primary purpose of this mission was to sample from prospects where Soviet geologists had earlier published promising results. At the “Shaida Deposit” site, more than a dozen Soviet trenches were found, all trending orthogonal to three north-south trending zones of copper mineralization. The trenches were several meters wide, a few meters deep, and tens of meters long, in one case several hundred meters long. The team sampled three major trenches, identified on Soviet maps as trench lines K12, K2, and K1. At “Shaida I”, five Soviet trenches at 10-15 m long and four open-pits were identified. At “Shaida IV”, the team recognized five shallow trenches separated by several hundred meters. Only one trench was accessible due to the close proximity of a local village.

Another purpose of the mission clarification of the deposit model for the Shaida district, which could have important ramifications for economic viability. Whereas VMS deposits are generally

of high grade, they tend to be of modest to small size. Copper porphyry deposits, however, tend to be of low grade but large in size, and, thus, are the world's leading producers of copper.

There is significant potential for one or more copper ore bodies in the Shaida district. Several factors lead to this conclusion:

(1) The geological setting of the district is instructive. All the stops made by the mineral assessment team were in volcanic or volcano-sedimentary rocks, rich in copper sulfide or copper carbonate minerals, bearing the signs of extensive hydrothermal alteration (potassium metasomatism) and fracturing (extensive stockwork quartz veins). From a regional perspective, the volcanic strata overlie a large granite massif, and, in many places, apophyses of the underlying granite stock were seen as sheets, dikes, and sills of granite porphyry and aplite. Thus, the volcanic rocks comprise the roof of a very large intrusive igneous complex. Moreover, the volcanic roof of the complex is still present (i.e., not eroded away), signaling other mineralized zones, perhaps richer in grade, may be present at depth.

(2) The presence of deep-seated mineralization is suggested by the presence of an iron oxide gossan, perhaps five meters thick, resting above brecciated and copper carbonate-stained phyllite at the "Shaida Deposit". Gossans such as this form when valuable metals, dissolved in oxidizing surface waters, precipitate as oxide, hydroxide, and carbonate minerals deep in the water table under reducing conditions. Over time, these "supergene minerals", enriched in iron hydroxide minerals, accumulate to significant thickness. Additional significant supergene minerals include copper, lead, zinc, gold, silver, nickel, manganese, and uranium. These gossans, brown from the iron hydroxide minerals, are useful indicators of subsurface mineralization to prospectors and exploration geologists.

(3) The initial assays from the Shaida district are very promising. Twenty-three samples were taken from this site for geochemistry, and results for several field samples indicate copper concentration near ore-grade levels of 20,000-60,000 ppm. Geochemical results for arsenic and zinc are also anomalously high.

In summary, the team's field observations support classification of the Shaida area as a copper porphyry deposit rather than a VMS deposit:

> "The Shaida area, initially described as a possible VMS deposit, is better classified as a copper porphyry prospect of promising size and richness. At all three stops the mineral assessment team discovered highly altered (sericitized) and mineralized stratified rock (quartz keratophyre and phyllite), Cu-bearing stockwork veins, and brecciated and altered sheets of granite porphyry. The three stops are within a few km of a large granitic stock, and it is evident that the stratified rocks comprise the mineralized and altered roof of a very large intrusive igneous complex. The magnitude of the alteration and mineralization was not quantified, but it covers an area of at least 20 square km and Cu-mineral stains are ubiquitous."[2]

Current Understanding
The Task Force team collected a variety of Cu-sulfide bearing and Cu-carbonate stained rocks, some of which are of ore grade richness. Additional sampling, mapping, and geophysics would further clarify the size and value of this deposit. Certainly the calculated potential undiscovered

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[2] USGS Field Report

resources, combined with near-ore-grade geochemical results, warrant further work as Dusar-Shaida could be a very important regional job creation opportunity for the Herat and Farah provinces.

Chaigai Hills

Several extensive known copper deposits are currently being put into production in Pakistan directly across the border from the Chaigai Hills area of interest in Helmand Province. While no exploration has been conducted on the Afghan side of the border, geological deposits do not recognize political boundaries. Likely, these structures continue into Helmand and Nimroz. In their 2007 report, USGS estimates there to be approximately three copper deposits in southern Helmand and Nimroz Provinces with a total resource of:

- 1,815.1 million tonnes ore
- 10.446 million tonnes copper

The known deposits located directly across the border in Pakistan, including Dashte-e-Kain, Saindak, and Reko Dik, contain significant amounts of copper and gold (details shown below).

Deposit	Million tonnes of Ore	Copper Grade %	Comments
Dashte-e-Kain	350	0.3	
Saindak	412	0.375	0.15 g/t gold
Reko Dig	807	0.645	0.35 g/t gold
Koh-i-Dalil	Prospect	Unknown	
Ziarat Pir	Prospect	Unknown	

Table 5. Pakistan Copper Deposits Adjacent to Chaigai Hills

In September 2009, a Task Force sampling team visited the Chaigai Hills area and examined the travertine and onyx mining sites at Arbu. The onyx sites visited were formed by water bodies fed by hot springs. Field observations confirmed Soviet reports of commercial potential for the deposits.

The estimated resources of travertine and onyx at these areas are greater than 500,000 tonnes in the largest deposit. Other deposits of equal or lesser value are also likely.

Additional work at the potential copper porphyry areas would provide job creation as well as border stabilization opportunities.

Copper

The USGS Preliminary Non-Fuel Mineral Assessment estimates that Afghanistan has nearly 60 million tonnes of copper distributed throughout the country in three types of model deposits:

- Volcanogenic Massive Sulfide (VMS) Deposit: Cu (Pb,Zn) dispersed in (mostly) sulfide minerals precipitated from hydrothermal vents on or below the paleo-ocean floor. Some VMS deposits are distinctive in that Cu ores formed by hydrothermal circulation and exhalation of minerals during submarine eruption of rhyolite or basalt magma. In that sense, the copper-rich minerals are not precipitated from hydrothermal vents. Deposits of this latter type (Kuroko) are commonly of high-grade (> 10% Cu) and small to modest scale (~ 1-10's million tonnes).

- Porphyry Cu Deposit: Copper ores associated with intrusive igneous rocks, and the fluids that accompany them, during magmatic emplacement and crystallization. Circulating water-rich fluids, of magmatic and meteoric origin, interact with hot magma and cool country rock to precipitate minerals enriched in copper, molybdenum, silver and gold. Porphyry Cu deposits are commonly of low-grade (< 1% Cu), but their exceedingly large-scale (> 100's million tonnes) makes them the largest producers of copper in the world.
- Sedimentary-Hosted Cu Deposit: Copper ores precipitated from circulating meteoric fluids that are bound within restricted, narrow horizons in sedimentary rocks, or their metamorphosed equivalents. The ores of copper are either epigenetic or diagenetic. That is they formed after the host sediment was deposited, but usually prior to lithification of the host. The Cu grades in these deposits are typically high, commonly between 1-6% Cu, and the tonnage varies greatly.

Copper VMS

As a class, VMS deposits represent a significant source of the world's Cu, Zn, Pb, Au, and Ag ores, with Co, Sn, S, Mn, Cd, Bi, and Te as co- or by-products. The Balkhab prospect, of Sari-Pul Province, is rated by the Task Force as the highest potential for VMS copper in Afghanistan. Other VMS-type deposits are present throughout Afghanistan and require additional evaluation.

Balkhab

The Balkhab copper prospect is located approximately 250 km northwest of Kabul in the valley of the Balkhab River between approximately 2,000-3,200 m in elevation. The prospective deposit is located in rocks previously mapped by Soviet geologists as Ordovician (~450 Ma) "sandstone and siltstonnee", overlain unconformably by younger sedimentary rocks of Jurassic (200-120 Ma) and younger age.

Prior to the Task Force's work in this area, little was known about the Balkhab deposit, although subsequent work has shown it to be a deposit of high grade and potentially large-scale. There are small signs of ancient working in the area, some older than 3,000 years, including piles of unrefined copper (slag) and shards of broken copper bowls. However, the Afghan Geological Survey considers the prospect to be primarily a modern discovery.

Under the direction of the Task Force, the AGS has also photographed and documented the ancient shafts and tunnels at Balkhab, showing extensive evidence of copper mineralization as brilliantly colored malachite and azurite. The AGS has worked extensively with the Task Force to map the prospective ore body and to sample the bedrock and soil for geochemical assay. More than 1,380 samples collected by the AGS and the mineral assessment team are currently undergoing XRF (X-ray fluorescence) and ICP-MS (inductively coupled plasma-mass spectrometry) analysis by USGS in the United States and by a commercial laboratory in the region.

The Task Force work at Balkhab included a scoping mission in November 2009 by the mineral assessment team. The summary below is a synopsis of their report:

Field observations by the Task Force mineral assessment team outlined three principal bedrock units:

1. An oldest sequence of highly sheared, low greenschist facies metamorphic rocks. These were previously described by Soviet geologists as sandstone and siltstone of presumed Ordovician age. This sequence is exposed in the Balkhab River valley and in sections of

smaller streams. The mineral assessment team believes that copper sulfide mineralization is restricted to layers making up this unit:

> "Close inspection of the quartzo-feldspathic layers reveals they are extensively mineralized, in zones centimeters to meters thick, with euhedral cubes of pyrite. In one layer, near the margin of a felsic volcanic unit (rhyolite), a thin seam (< 8 cm) of hexagonal pyrrhotite-bornite ore was observed. Subsequent weathering of the pyrite-rich seams and layers has left an iron-oxide staining on the rocks visible for at least 200 meters up the southern wall of the Balkhab River valley."[3]

2. A medium-to-fine-grained biotite-chlorite granite porphyry that intrudes the metamorphic rocks described above. The granite porphyry forms a number of small stocks and sheet-like masses tens of meters thick, some of them with visible xenoliths of schist and phyllite, presumably of the oldest sequence. Locally, the stocks and sheets of granite are in fault contact with highly-sheared schist and phyllite.
3. A youngest sequence of nearly flat-lying sedimentary rocks that overlie units 1 and 2, above, with apparent unconformity. Soviet geologists portrayed these as Jurassic and younger sedimentary rocks comprised of sandstone, shale, and limestone. This sequence is only seen in the upper tributaries of the Balkhab River and it was not visited by the mineral assessment team.[4]

The mineral assessment team observed the contact between units 1 and 2 at only a few places, but because the granite was not metamorphosed and contained xenoliths of metamorphic rock, the team inferred that the granitic rocks (Unit 2) were intruded after metamorphism of Unit 1 and before deposition of sedimentary Unit 3.

In the opinion of the mineral assessment team, the mineralized system at Balkhab may be of the "Kuroko Type," as previously described by Kafarskiy and others (1972):

> "Samples collected in the main area of alteration associated with previous mining activity at Balkhab confirm the volcanogenic character of the mineralized rocks. Samples of fine-grained intergrown hexagonal pyrrhotite, chalcopyrite, and bornite from outcrop and relict layers of pyrrhotite in samples from the slag pile associated with mining activities both are characteristic of a volcanogenic genesis. That the sheared felsic rocks contain interlayered narrow zones of mm-wide pyrite cubes suggests that the copper-mineralized rocks may be associated with the felsic, in turn further suggesting that the mineralized system may be a Kuroko type."[5]

This is supported by the trace element geochemical data of samples collected from the region.

Hydrology in Support of Potential Mining

There is sufficient water available in the Balkhab River to support mining. The flow of the Balkhab River is considerable, though there was little to no flow in nearby tributaries and no evidence of springs present in the sedimentary rocks in the river valley walls during the Task Force assessment. This may be seasonal, with springs appearing during winter and spring when recharge would likely increase. When the team visited the area, conditions were probably at or near minimum annual flows as there had been no recent precipitation.

The field team did make note of several small-scale power generators in the area supported by the Balkhab River or small springs. At one site the spring was dry, so the generator was not

[3] USGS FIELD REPORT
[4] USGS FIELD REPORT
[5] USGS FIELD REPORT

operational. At another site, where the team discovered copper slag evidence, a Chinese-made generator was operational and powered by a canal diverted from the Balkhab River.

AGS Field Work

AGS leadership and the Task Force agreed in the spring of 2010 to make Balkhab a site of joint effort and focus. AGS work at Balkhab dates back to the summer of 2006, when a crew from the Ministry of Mines was dispatched to investigate reports of copper mineralization. The AGS followed up on the slag and hand samples brought back and spent the summers of 2008 and 2009 mapping and sampling. The crews have outlined what they believe to be the main mineralized zone and have collected hundreds of samples which are being assayed through the Task Force program at the USGS laboratory.

In 2010, the USGS outlined a grid-sampling program for AGS with 50 meter pacing and an expected sampling volume of 1,000 samples per 1 km^2. The main mineralized body is believed to be several kilometers long and between 30-50 meters wide.

Remote Sensing Work

The sections below summarize new work conducted using remote sensing technology. This work has provided the Task Force team with new areas of interest in Balkhab that present opportunities for the Afghan government to gain revenue through exploration and exploitation licenses.

The true impact is that this work has broadened the potential of Balkhab from that of a small mining opportunity to a larger potential mining district. This change in scope is significant because it means increased job opportunities in the region and substantially more tax revenue to the local, provincial, and national governments.

The Task Force contracted Remote Sensing Enterprises with digitally processing and interpreting Landsat images of Balkhab in order to identify additional potential areas of mineralization outside of those known to the AGS field crews and USGS. The purpose of this work is to better understand development opportunities at Balkhab and determine what resources the Afghan Ministry of Mines could put out for exploration tenders.

With this technique, the remote sensing subject matter experts outlined the following objectives:

1. Evaluate rock alteration patterns that may indicate mineralization.
2. Focus on individual alteration anomalies that are practical targets for field investigations.
3. Improve understanding of the regional geology so the deposit itself is seen in the appropriate context.

The remote sensing package delivered to the Task Force team included a new geologic map of the Balkhab area with four major rock units identified as having mineral potential. As can be seen in the report itself, “Member 1” in the metavolcanic unit was previously unknown but is significant because it hosts most of the alternation anomalies recognized using the Landsat data. As can be seen on the new geologic map below, the alteration patterns are clear within this unit. The team also identified seven alteration subareas, each of which has a minimum of three alternation anomalies, meaning that the team has identified a total of 21 alteration anomalies. Detail on these anomalies can be found in report “Landsat Analysis of Mineral Anomalies, Balkhab Region, Afghanistan” (Sabins, Ellis 2010).

By focusing on these anomaly packages, the team has narrowed future fieldwork from close to 700 km^2 of area to be covered to 35 km^2—a considerable leap in both the understanding of the deposit and an improvement in the effectiveness of future fieldwork. These anomalies have been registered to 3D high-resolution satellite terrain models which will assist with planning and conducting field exploration.

HyMap hyperspectral data provided by USGS to the remote sensing subject matter experts was used as an input for new statistical models in order to maximize the impact of that data on exploration. Additional work with the hyperspectral data will be conducted as work progresses. As this technology is cutting edge, new techniques and tools are constantly being developed and fine-tuned.

New products are below:

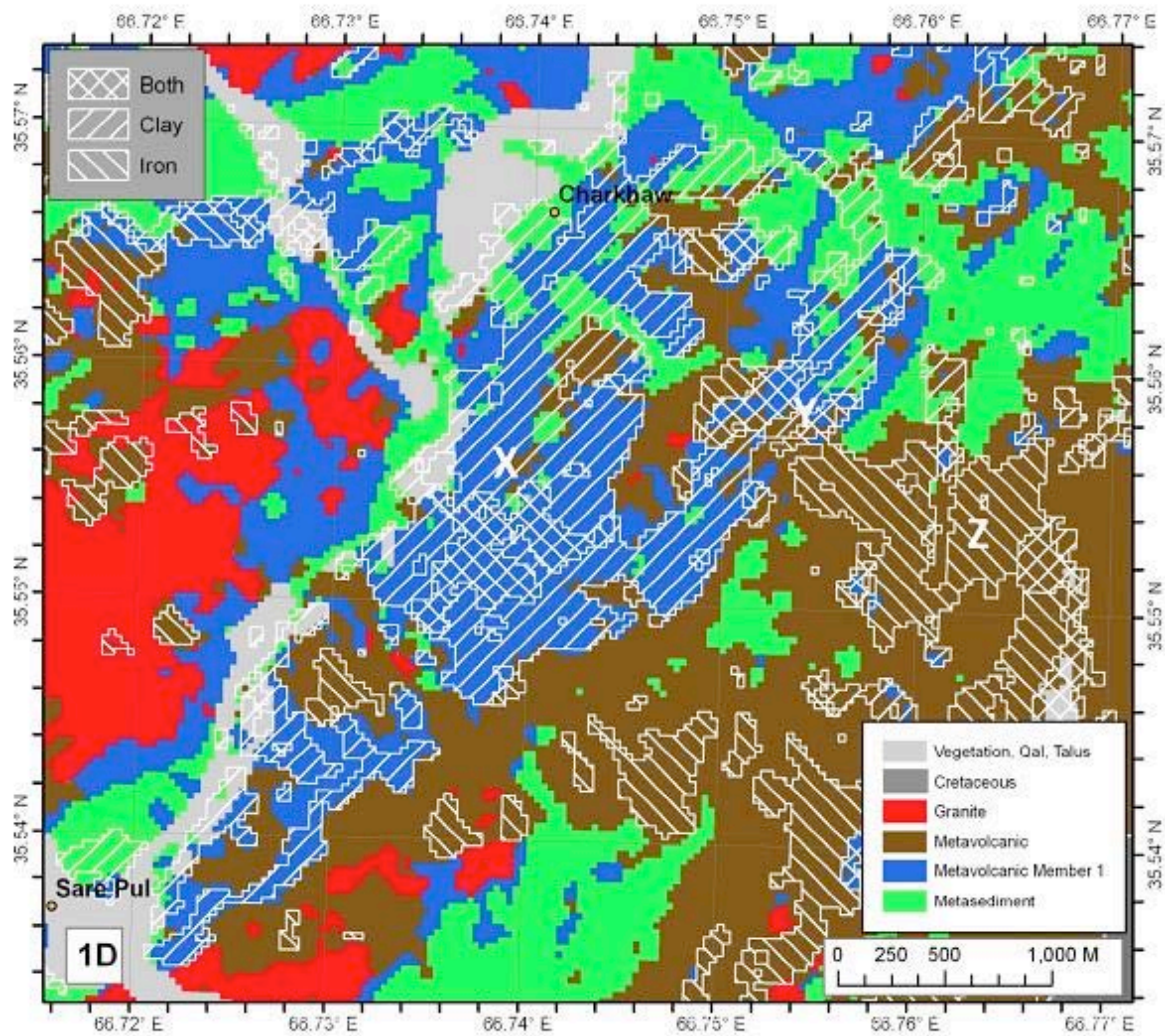


Figure 5: Balkhab TM Subarea 1 classification map showing the four major rock classes. This map, also produced for the entire Balkhab area of operation, is essentially a geologic map of the rocks with mineral potential.

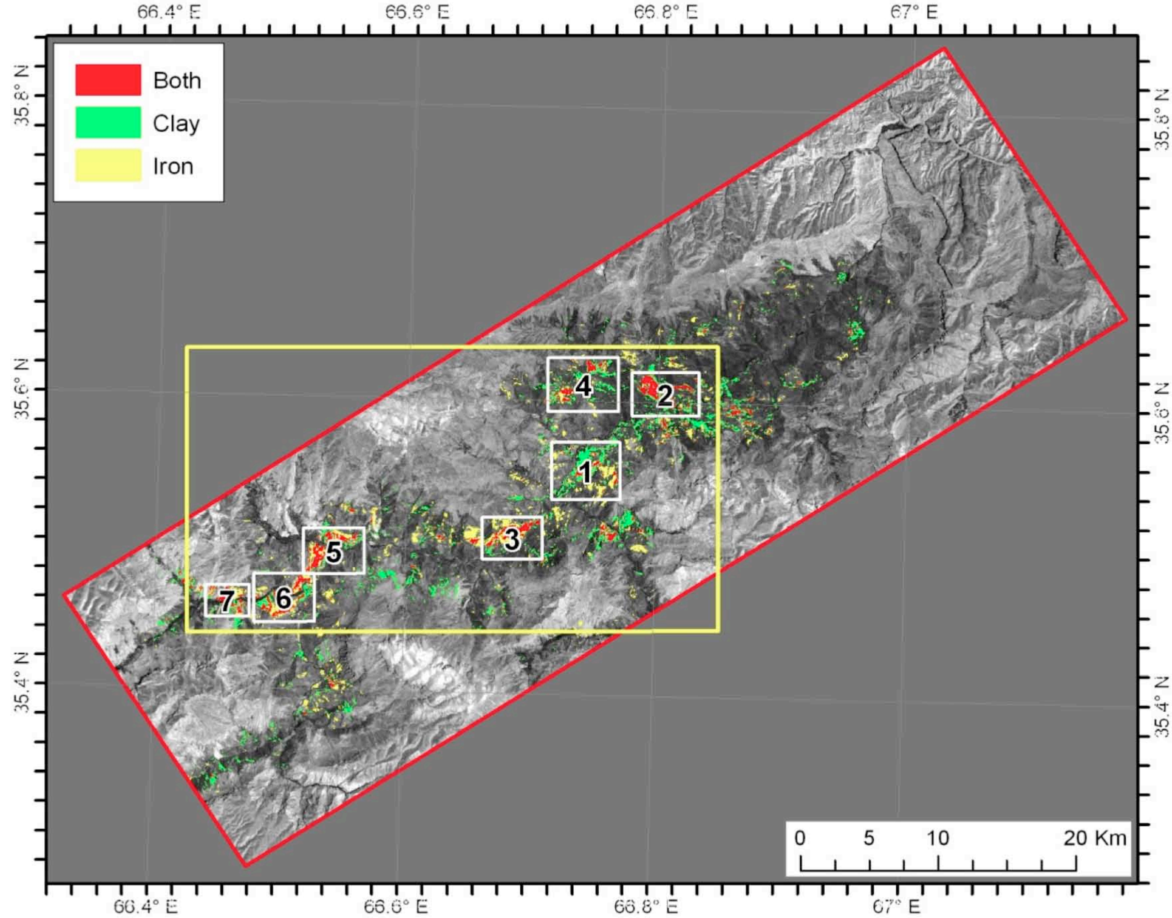


Figure 6: Alteration image of Balkhab area of interest. The yellow outline shows the region of the Balkhab alteration, and the white outline shows the subarea alterations.

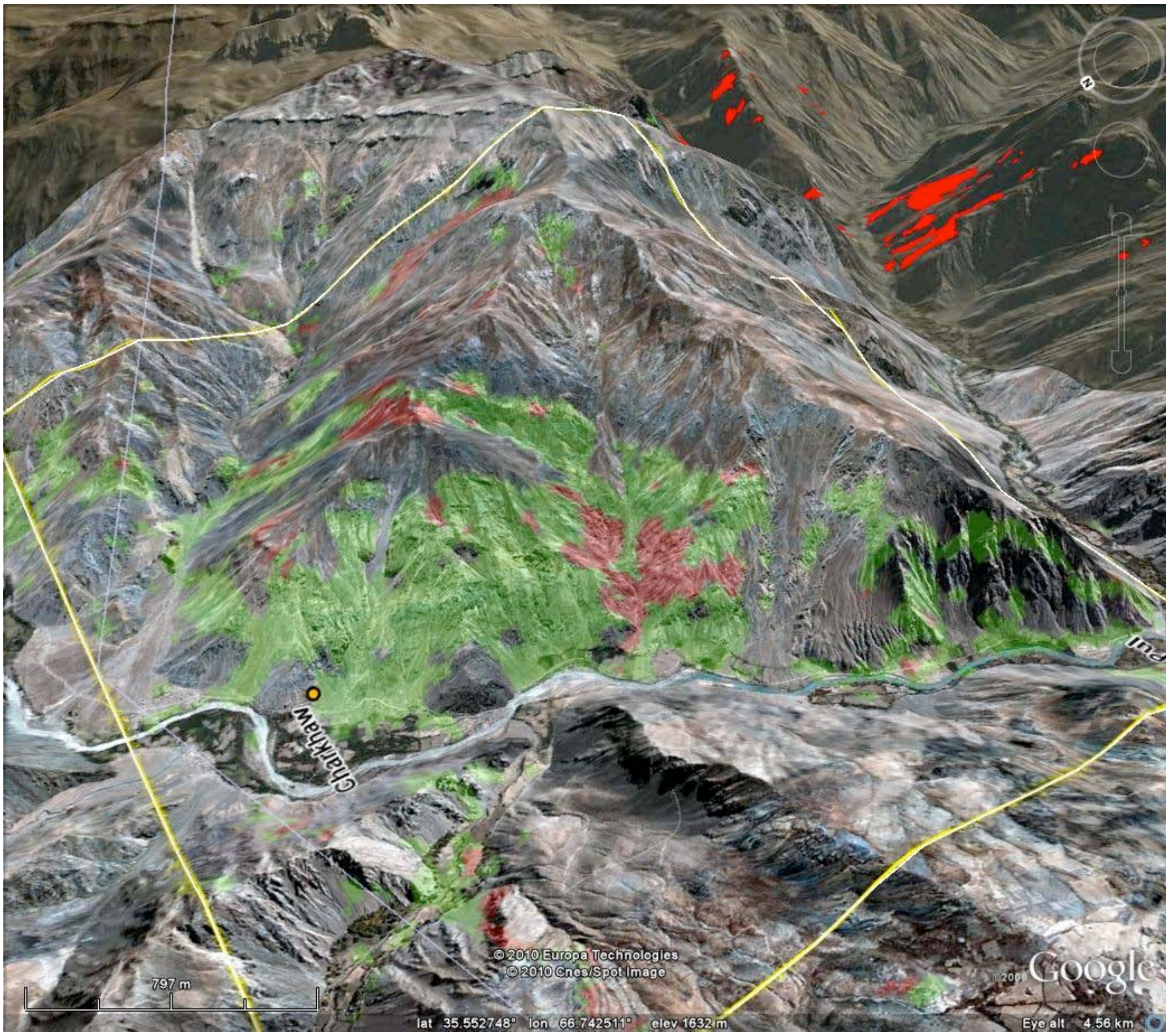


Figure 7: Balkhab Alteration Subarea 1. Alteration patterns draped on IKONOS high resolution (75cm) satellite images with Anomalies X and Y in the foreground. Anomaly Z is partially obscured by topography, but can be viewed by looking from an alternate direction. Green zones are alunite and clay, while red is iron plus alunite and clay. The view is toward the southeast from west of the Balkhab River. Vertical exaggeration is 1.5x. The yellow outline is Subarea 1.

Current Understanding

Selected samples from the 2010 collection grade up to 0.25 to 1.34 weight percent copper, and slag samples grade up to 1.66 weight percent copper. These results support AGS's theory that the area contains promising copper mineralization and high potential for exploration and production. In addition, the assays indicate that surface samples in the Balkhab prospect consist mostly of oxide ore that is easily mined and converted to copper metal with minimal infrastructure investment and low-skilled labor.

Geochemical analyses of returned samples, and field observations by the minerals assessment team, favor the view that the Balkhab prospect is a VMS deposit of the Kuroko type. The mineralized zone is 4,000 to 5,000 meters long and 300 to 400 meters thick and it is hosted within a sequence of felsic volcanic and volcanogenic metasedimentary rocks characteristic of Kuroko-type deposits. Measurable seams of coal in the overlying sedimentary strata, as well as

an abundant supply of water in the Balkhab River, are sufficient to support viable copper production.

New remote sensing and hyper-spectral analyses point to 21 anomalies that will be the topics of future work in 2011.

Sedimentary Copper

North Aynak

The largest known copper deposit in Afghanistan is Aynak, located approximately 20 km south of Kabul. This sediment-hosted deposit has resources estimated at greater than 12.3 million metric tonnes of copper. The USGS estimates an additional 17 million metric tonnes of copper and 600,000 tonnes of cobalt are located in nearby areas – some of which fall under the North Aynak area examined by the Task Force. The Aynak copper deposits have been mined for hundreds of years, and recently discovered archaeological sites indicate even older ancient working.

The Aynak district is informally divided into North Aynak and South Aynak. The Metallurgical Corporation of China was awarded concession for the South Aynak prospect in 2008 (Figure 9). A common misconception is that MCC was awarded the entire economic district, when, in fact, the USGS estimates that greater than half of the copper deposit could lay outside of the MCC concession. In the graphic below, the small orange squares are reported mineral occurrences within the unawarded North Aynak prospect, outlined in the yellow rectangles.

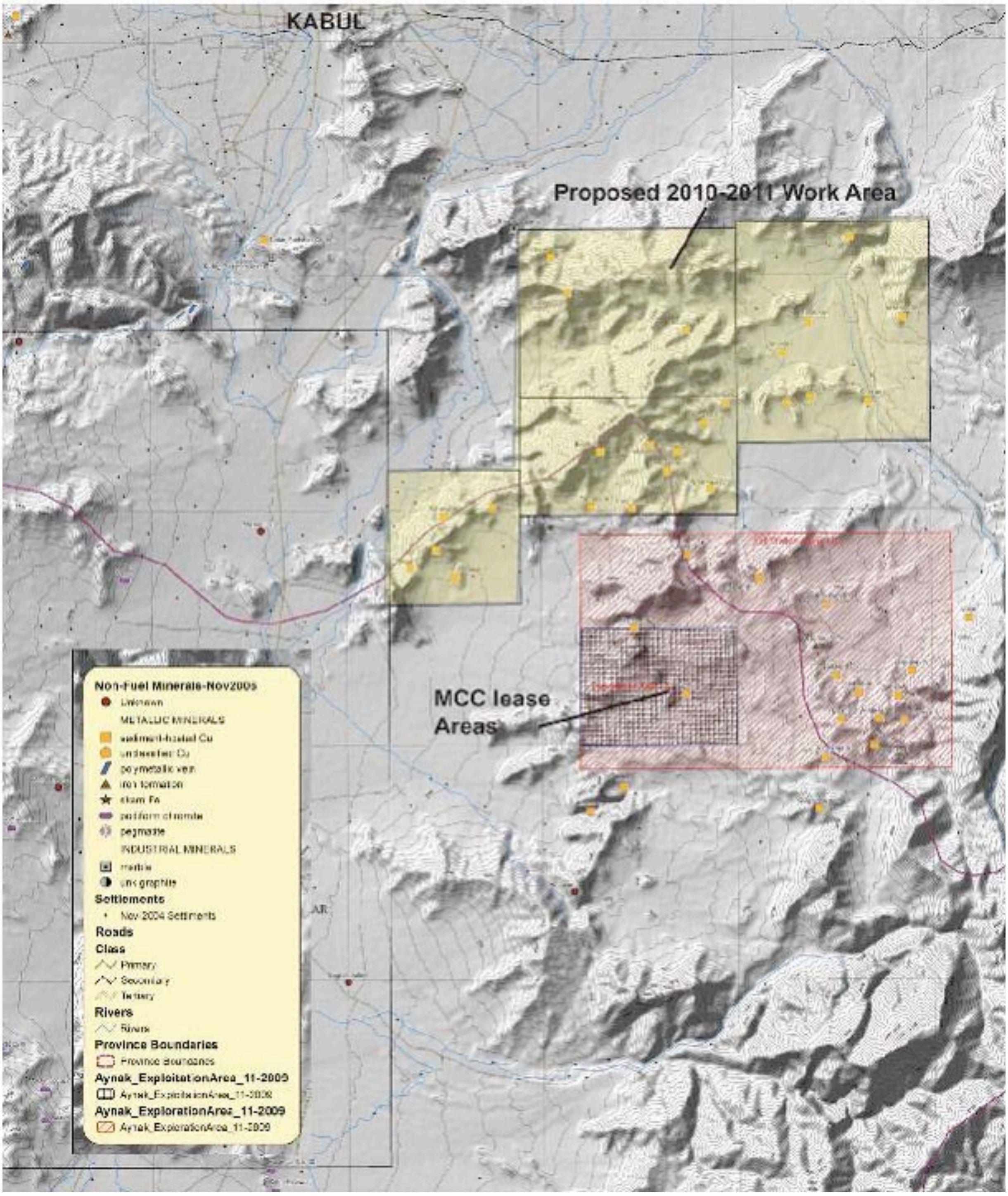


Figure 8: Aynak location map. Orange area is South Aynak, yellow rectangles are North Aynak.

The ore-bearing stratigraphy of the South Aynak area is traceable directly in the North Aynak area. For this reason, the Task Force recognizes significant potential for copper mineralization in North Aynak. However, additional field work in North Aynak should be limited and focused. Additional work should focus on the Loy Kjwar Formation's presence in North Aynak, as units 3 and 5 of the 7 member units in Loy Kjwar display stratabound copper mineralization in South Aynak. The mineralization at South Aynak is characterized by "bornite and chalcopyrite

disseminated in dolomite marble and quartz-biotite-dolomite schists of the Neoproterozoic Loy Khwar Formation."[6]

The area sampled was approximately 15 km north of the MCC concession, approximately 50 km southeast of Kabul, at an elevation of 2,300-3,000 m. Four sites were identified for sampling during the scoping mission:

- Yagh Darra (34.4235N, 69.2547E)
- Bagkhei-Zakhel (34.357N, 69.284E)
- Khurdkabul (34.375N, 69.359E)
- Dawrankhel (34.403N, 69.412E)

Upon comparing field observations with expected evidence of mineralization, the team thinks the sampling locations may have been misidentified or inaccurate, as there was little to no evidence of exploration or mineralization. Only one example of mineralization was seen and it did not match the data presented by the Soviets. This site visit enhanced the team's regional geologic understanding of the deposit: the metamorphic rocks of North and South Aynak have much in common – both districts include marble, quartzite, paragneiss, and small intrusive igneous rocks.

Findings from the USGS field report on those locations are summarized below, with additional detail provided in the 2010 Administrative Report to TFBSO.

At Yagh Darra, the team saw signs of copper mineralization that consisted of rare green copper carbonates in marble and calc-silicate gneiss at or near the contact with magic and felsic metavolcanic strata. There were signs of quarry activity, but only one indication of copper mineralization. Streams to the west of the site drain north into the Logar River, and streams to the east drain into the Bulkhak River. Both rivers flow into the Kabul River, about 30km southeast of Kabul City.[7]

At Barkhei-Zakhel, Khurdkabul, and Dawrankhel, the sequence is simiar to Yagh Darra, and there were no signs of epigenetic alteration throughout the Precambrian rock sequence.

In summary, during these field missions, the Task Force visited areas with little potential for exploitation as all are underlain by high-grade metamorphic rocks. But the confirmation of commonalities with the Loy Khwar Formation between North and South Aynak causes the North Aynak district to remain rated as "somewhat favorable for stratiform copper mineralization". The team believes there is potential for mineralization, but additional work is required to correctly identify target areas. The work described below on remote sensing packages at North Aynak is a logical tool to be used for that purpose, and as such will add great value to potential North Aynak development. [8]

[6] USGS FIELD REPORT
[7] USGS FIELD REPORT
[8] USGS FIELD REPORT

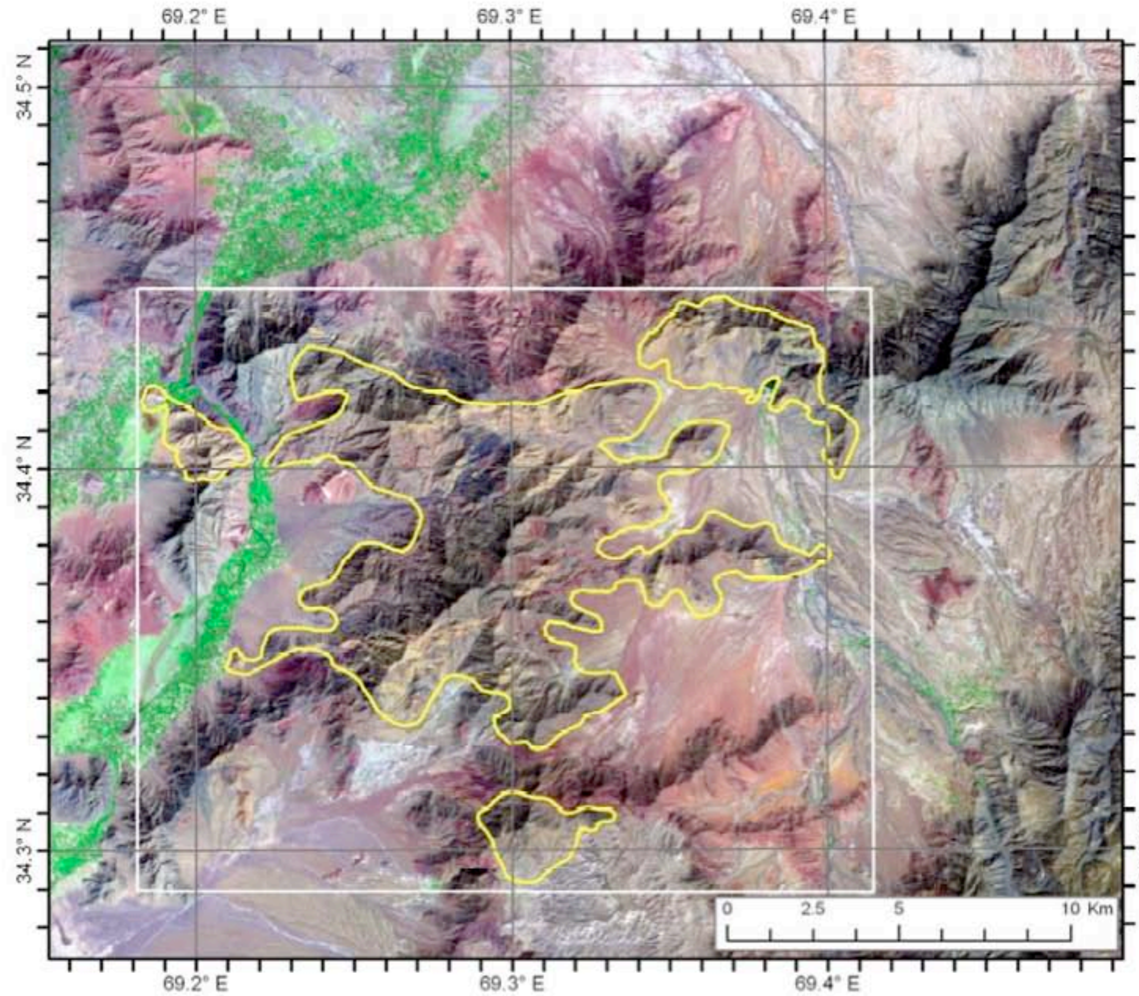
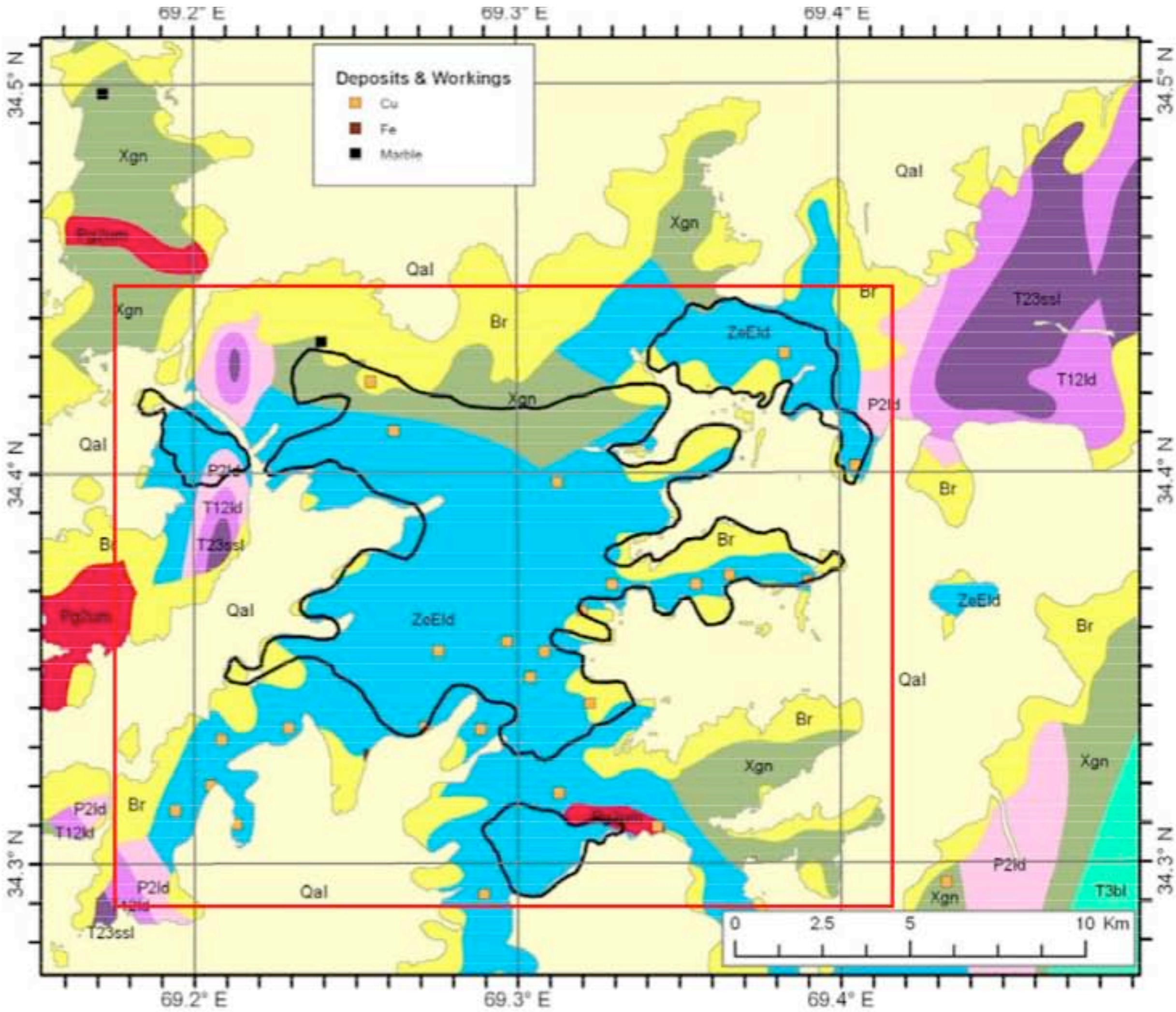


Figure 9: North Aynak Landsat TM enhanced color image. TM bands 1-4-7 are shown in blue-green-red. Yellow outline is the Loy Khwar Formation that hosts copper deposits. On this and the following maps and images, the Loy Khwar outline is taken from this image—not from the Russian geologic map (Figure 11). After spectral analyses of ASTER and HyMap images, we now know that the distinctive tan-colored outcrops within the Loy Khwar Formation are dolomite members. A short distance to the south, dolomite members are the host rock for the Aynak world-class copper deposit.



Map symbol	Geologic Period	Lithology
Qal	Quaternary	Young sediments
Br	Various ages of bedrock	Bedrock-misclassified as Neogene clastics
T23ssl	Mid. – Late Triassic	Sandstone & siltstone
T12ld	Early- Mid. Triassic	Limestone & dolomite
P2ld	Late Permian	Limestone & dolomite
Pg2um	Permian	Ultramafic intrusives
Zeld	Neoproterozoic –Edicarian/Cambrian	Loy Khwar Fm. Dolomite marble & schist
Ygbm	Proterozoic	Gabbro & mafic volcanics
Xgn	Paleoproterozoic	Gneiss

Figure 10: Soviet geologic map (Doebrich and others, 2007) and legend of North Aynak. Unit Zeld (blue pattern) is the Loy Khwar Formation that hosts the mineral occurrences and deposits. The black outline is the correct outcrop of the Loy Khwar Formation mapped from TM images in this report. The unit Br is shown on the map as clastic deposits of Neogene age. The images, however, show that Br is actually a variety of older bedrock types. From Russian map digitized and annotated by Kalaly (2007). The outline of the red rectangle is the Loy Khwar subarea.

Remote Sensing Work

The Task Force contracted remote sensing analysis in North Aynak similar to the package commissioned on Balkhab. The objectives were to understand the geology of South Aynak as a model for North Aynak, interpret the geology of North Aynak focusing especially on the Loy Khwar Formation that surrounds South Aynak, and, within that formation, distinguish the

dolomite member that hosts the South Aynak deposits. The team focused on recognizing altered outcrops of the dolomite member as potential mineral deposits and then combined all products created to identify mineral alteration anomalies warranting additional investigation.

The map below displays new target areas for follow-up investigation that resulted from this work focused on the Loy Khwar Formation area. Twelve target areas were identified, providing significant feedback to the fieldwork team for planning and execution of detailed exploration.

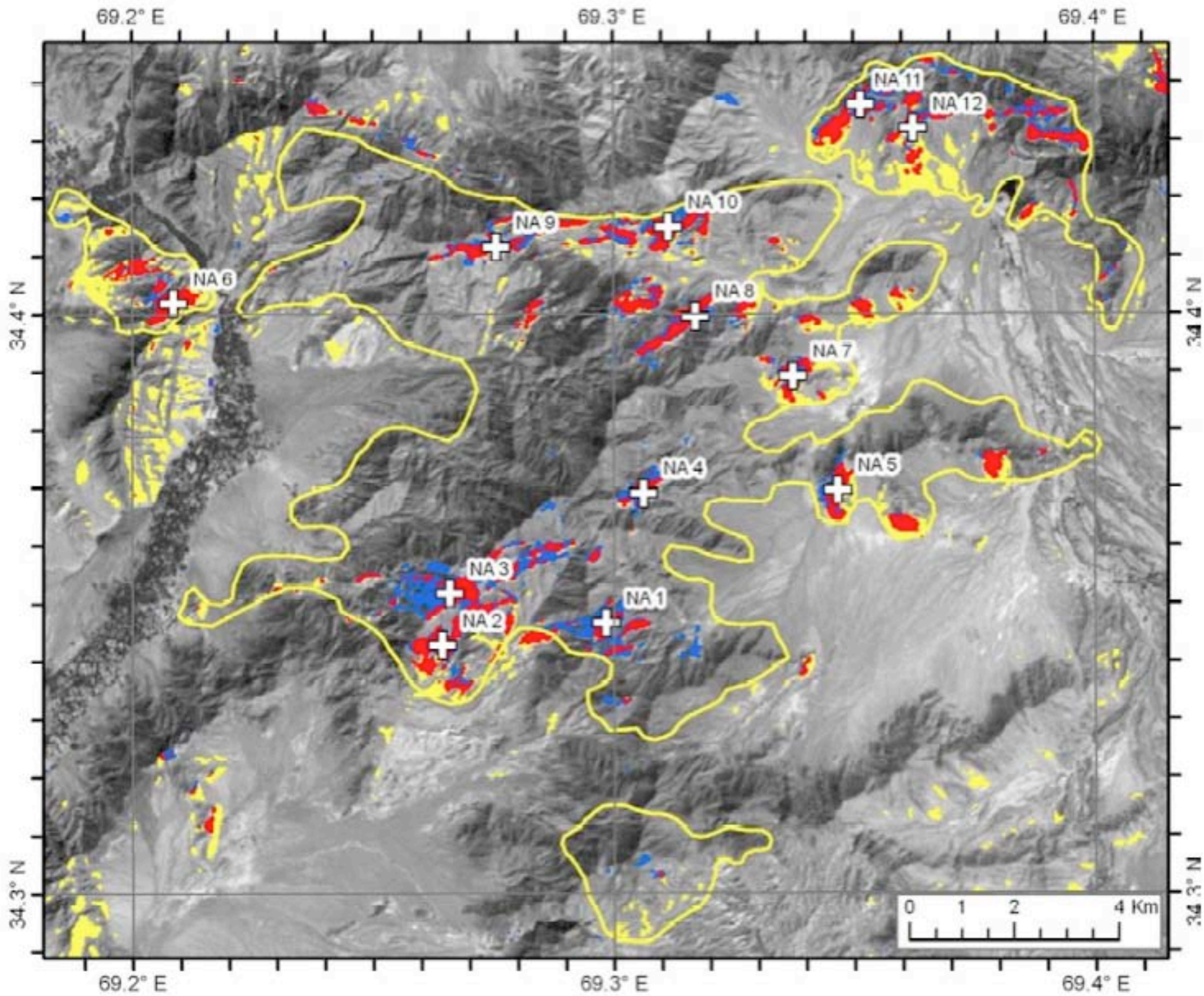


Figure 11: Map of alteration anomalies for future exploration of copper mineralization at North Aynak.

Current Understanding

Task Force remote sensing found 12 new anomalies worth exploring that are similar to the mineralization found in South Aynak. While this year's sampling effort did not confirm the mineralized opportunities, it did correct misclassifications of the geologic setting and clarified where future sampling and exploration works should occur.

Rare Earth Elements

In their Preliminary Non-Fuel Mineral Assessment, Peters et al. (2007) present both rare earth element and uranium grades for the Khanneshin carbonatite of Helmand Province. Peters et al. (2007) estimate the undiscovered deposits to be 1.4 million tonnes of REE, 3.5 million tonnes of niobium, and 6.2 million tonnes of phosphorus. Peters et al. (2007) also suggest significant prospects of uranium, thorium, barite, fluorspar, and nepheline are likely, without giving quantified estimates.

At the time that Peters et al. published their 2007 assessment, not all Soviet era reports were available. In May-June 2010, the Task Force located three major reports by Soviet scientists in the library of the AGS. After digitizing, translating, and thoroughly reading the reports, the Task Force estimated that reserves of uranium alone could be worth as much as $200 million. This represents a significant increase in the estimated mineral wealth of the Khanneshin carbonatite.

Carbonatite is widely recognized as a potential source of niobium (Nb), rare earth elements (REE), uraniuim (U), and thorium (Th), all highly strategic commodities in today’s high-tech market. Many carbonatites also host significant ores of phosphorus, titanium, iron, manganese, apatite, barite, fluorite, vermiculite, and nepheline, all important commodities for agriculture and commercial industrial production. Thus, from a single massif, the Khanneshin carbonatite could be a source of many different commodities and a multi-product mining district providing jobs to a wide array of people.

Task Force geologists used reinterpreted Soviet data to conduct two scoping missions.

Carbonatite

Khanneshin

The Khanneshin massif is located in Helmand Province, just south of the Helmand River, in the Registan Desert. The mountain is actually an inactive volcano, approximately 10 km in diameter and rising approximately 700 m above the desert floor. Its interior “caldera” measures about 2.1 km by 3.1 km (Alkhazoy 1978).

The volcano’s formation dates back to the early Quaternary Period through several episodes of volcanic emissions and magma emplacement. Its composition makes it unusual: the massif is composed almost entirely of calcium carbonate (with trace Mg, Fe) that crystallized as an igneous rock. These rare and unusual carbonites are greatly enriched in the “incompatible” elements (i.e., niobium, uranium, thorium, rare earth elements) that combine easily with the carbonate, fluorine, and phosphate anions (CO_3^{-2}, F^-, PO_4^{-2}) to form stable and economically valuable compounds. The various eruptive rocks, as well as the magmas that intrude them, are highly significant, as the REE rich zones and the other economic minerals are found within distinct zones. A critical part of the exploration process is to determine the location, geometry, size, and richness of the zones that contain the minerals of interest and to project beneath the ground surface where these zones may extend.

The USGS estimates that there are 14 million tonnes of rare earth elements in Afghanistan, including the content of the Khanneshin deposit.

Soviet Reports
The team worked with AGS to scan and translate four previously unavailable Russian reports on Khanneshin. These reports are listed below along with a photo demonstrating the fragile condition of the original reports.

1. Yeremenko, G.K., 1975, Short characteristics of carbonatite paleovolcano Khanneshin. AGS Archive #: 1322 Kabul, 1975. Inv. # 177 (crossed out), 157 Written in Russian. 14 page report with 1 attached map, 5 additional maps, and 5 maps that are missing.
2. Chmyrev V.M., 1976, Nuristan crew report on the results of the geological-prospecting works for solid commercial minerals deposits in Afghanistan for 1975. AGS Archive #: 1028 Kabul, Jan. 1976. Sent to Moscow AM-13-33/187 by Feb 2, 1976. Written in Russian. 69+ page report and 10 missing map *(electronic scans of maps have not been retrieved from an LTO storage cartridge).*
3. Cheremitsyn, V.G., Yeremenko, G.K., 1976, Report of the Khanneshin crew on the results of the prospecting-evaluational activity for 1976. AGS Archive #: 1142 Kabul, 1976 Written in Russian. 84 page report with 7 maps Copy #1: 6/7 maps and no report. Copy #4: 7/7 maps and report.

These reports were translated and interpreted by a Task Force commercial geologist, whose interpretation provided context and additional data in preparation for a fall 2010 field mission to Khanneshin. Task Force team members then assisted him and USGS team members in digitizing the Soviet maps and overlaying them on modern GIS and Google Earth tools.

Soviet geologists, in partnership with the Afghan Geological Survey, carried out a considerable amount of prospecting and geologic mapping at Khanneshin. Their results indicated significant concentrations of uranium, phosphorus, thorium, REE, and fluorite, as mentioned above. In addition to those reserves, previously unavailable Soviet reports estimate a reserve of 4,150 tonnes of uranium ore. This additional reserve estimate is interesting because, at that time, the Soviets were very focused on discovering and exploiting uranium deposits and would have been very careful in their calculation and reporting of any uranium resources.

In 1974, rare earth elements and uranium-bearing minerals were first discovered at Khanneshin by the "Nuristan Crew." This first crew authored Report 1322, which was sent back to the Soviet

government for review. It is speculated that a crew specializing in and focusing on uranium was then assembled and sent to continue work on Khanneshin, replacing the Nuristan crew which was capable but more generalist in nature.

From 1975-1977 the “Khanneshin Crew” was assembled and conducted extensive trenching, mapping, aerial radiometric surveys, topographic grids, and sample analysis at Khanneshin. The findings of Report 1142 indicated that three sites were rated as highly prospective for REE and uranium occurrences. While three were rated as highly prospective, there are occurrences mapped all over the volcanic cone. REE are mapped as being concentrated in the central northeast part of the volcano, with uranium occurrences on the southwest and northern slopes.

Below is a digitized version of maps found in the Soviet reports and a photo of an original Soviet map. The scanning and digitization of these maps in crucial as it allows geologists to make use of this valuable Soviet data using modern-day technology and tools.

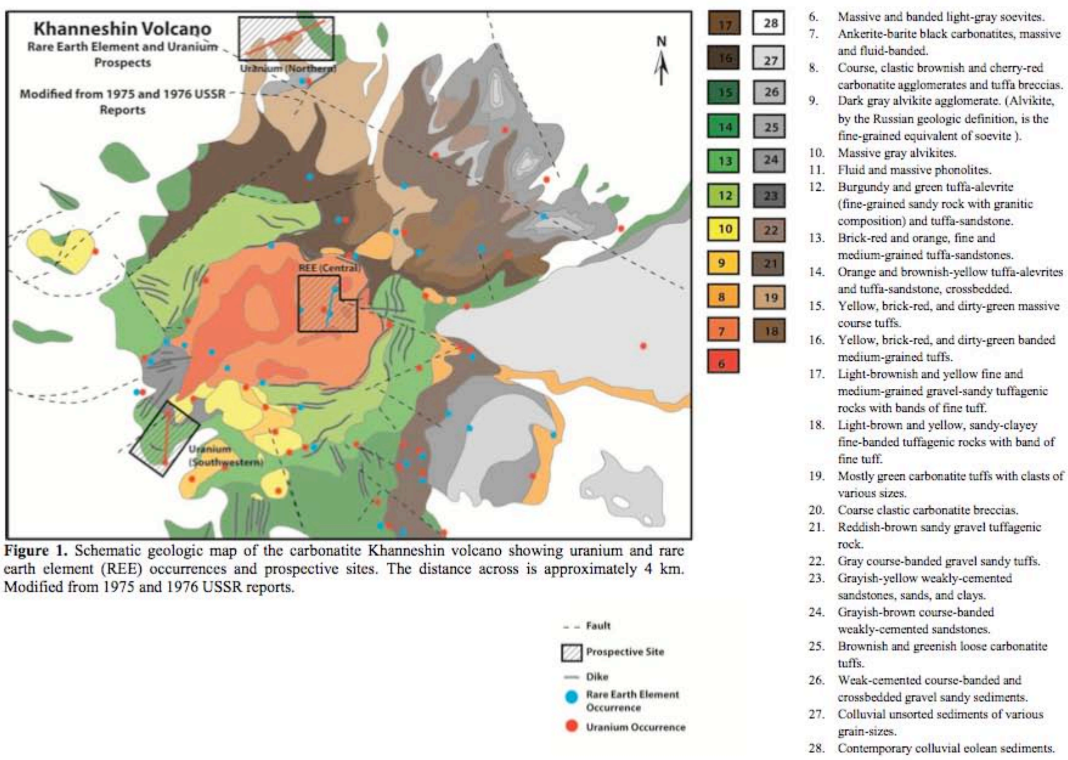


Figure 1. Schematic geologic map of the carbonatite Khanneshin volcano showing uranium and rare earth element (REE) occurrences and prospective sites. The distance across is approximately 4 km. Modified from 1975 and 1976 USSR reports.

Figure 12: Digitized and compiled version of Soviet Khanneshin Maps

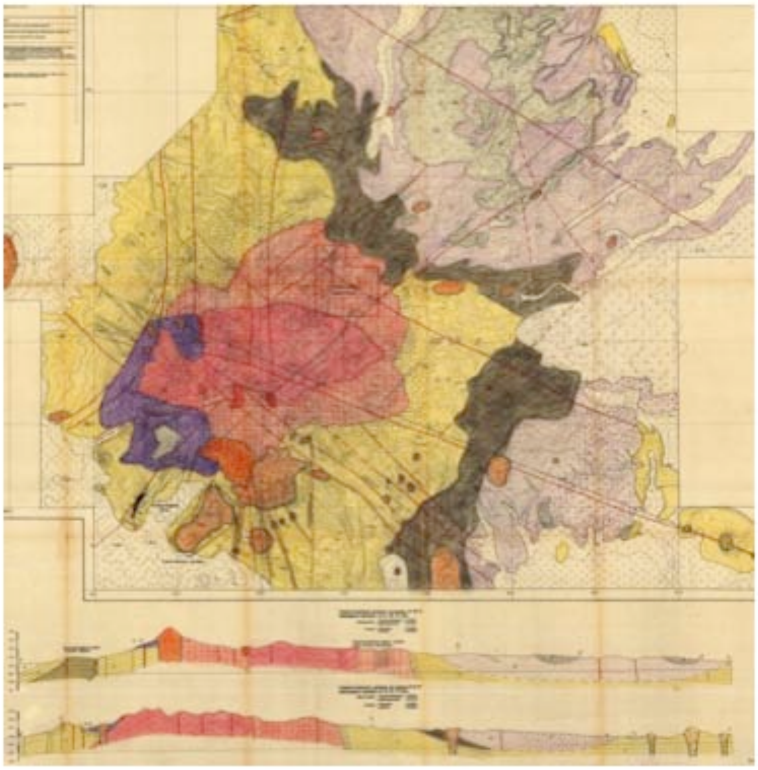


Figure 13: Original Soviet Khanneshin Map

The Khanneshin crew identified the five phases of carbonatite eruptions. The first four containing REE mineralization were studied in the most detail. As a Task Force commercial geologist notes in his interpretation, the “oldest carbonatite is in the middle of the caldera, surrounded by dikes that extend outwards and, in places, have penetrated the lower slopes of the volcano”. These carbonatites are differentiated by iron content into:

a. Soevite – coarse-grained calcite carbonatite
b. Alvikite – medium to fine-grained calcite carbonatite

The reports indicate that fluorite is found in enriched zones up to 25 percent of rock volume and REE carbonate minerals sometimes make up 50 percent of rock volume. These REE zones are 3 to 50 meters thick and 250 to 1,000 meters long. Five zones were discovered, but more are potentially present under the extensive top cover (also known as colluvium).

The crew conducted wet chemistry on samples from the trenching, and the sum of all rare earth elements was found to be between 0.5 to 13 percent with an average of 3 percent—a highly economically significant deposit.

In the northeastern part of the volcano’s caldera, the crew documented 50 ore bodies with dimensions ranging from 1m by 0.5 meters to 500 meters by 50 meters in size. No vertical dimensions were established but they are believed to be near vertical as they are in the main volcano vent.

In reports from 1975, the crews document a pre uranium-type anomaly in the southwestern part of the volcano, but they were unable to find the primary ores. There were two large ore bodies, one 250 meters by 50 meters and another 100 meters by 10 meters, and several smaller ores approximately 20 to 50 meters by 7 to 10 meters.

In the northern uranium site, also a pure uranium anomaly, the radioactivity was measured at greater than 500 gamm. Report 1142 discusses this site and provides detailed grade and tonnage data with reserve estimates totaling 4,150 tonnes:

Total Area	Ore Body Length	Volume of Deposit	Volumetric Ore Weight	Calculated Ore Reserves	Avg Ore Grade	Total Reserves
10,000 m2	100m	1 million m3	2.35 t/m3	2,360,000t	0.176%	4,150t

Table 6: Soviet Reserve Calculation Table of Uranium Reserves

In addition to the compilation of the Soviet work, USGS scientists acquired data in 2001 and wrote a to-be-published paper "ASTER Spectral Analysis and Lithologic Mapping" by Mars and Rowan. Sand samples collected at Khanneshin by the team in the summer of 2009 were used to calibrate reflectance data. This data was then used to look at the Khanneshin carbonatite and distinguish the carbonate rocks within the volcano from the surrounding sandstone and other rocks, more clearly defining the carbonatite body.

The ASTER team used spectral reflectance and the emittance of carbonatites at other sites (producing REE) such as Mountain Pass, California and Iron Hill, Colorado.

Sampling Missions

The Task Force team conducted two separate sampling missions at Khanneshin – one in September 2009 and a second in August 2010. The 2009 team visited the uranium prospect in the southwest part of the volcano and the 2010 mission was a traverse from the edge of the volcano to the REE prospect in the northwest part of the central zone.

The 2009 mission was successful in confirming both the presence of carbonatite rocks and the general ore deposit model of the Khanneshin prospect. The team collected 25 samples from two sites which were analyzed for rare earth elements and trace-element concentrations. USGS results showed that the carbonatite magma is enriched in REE by two to three orders of magnitude – the enrichments are particularly high for the light REE. These findings indicate that the Khanneshin deposit is geochemically similar to a variety of carbonatites "known to host major REE deposits around the world."[9]

A Task Force team returned to Khanneshin in August of 2010, this time to focus on the REE prospect area in at which significant REE mineralization had been described in the Soviet reports (Cheremitsyn and Yeremenko 1976, Chmyrev 1976, Yeremenko 1975). The team hiked a traverse through the eastern portion of the volcano, approximately 3 km from the landing site to the ending point of the traverse. Approximately 50 samples were taken, totaling 85 lbs, and they were analyzed for their REE and trace-element compositions like the samples from the first mission.

The traverse of the second team crossed through the southern part of the mineralized prospect area and the contact line between agglomerate and sovite where the reports indicated REE mineralization is most abundant.[10] Field observations from this mission confirmed the geologic setting described by the Soviets, strengthening their argument for potentially significant

[9] USGS FIELD REPORT
[10] USGS FIELD REPORT

economic resources. The team also observed and collected samples from Soviet working pits at the far end of the traverse, allowing the team to very accurately compare modern geochemical results to those described by the Soviets.

The team did not reach the correct mineralized zone, but geochemical results are highly suggestive of extreme REE enrichments in some zones. As is to be expected in any carbonatite, the light rare earth elements are much more enriched than the heavies. This is quite normal as every carbonatite in the world is "fractionated" in this way. Lanthinum (La) and cerium (Ce) are present in percent concentrations, with the middle REE present in one order of magnitude less and the heavies in an additional order of magnitude less.

The heavy rare earth element results at Khanneshin are comparable to those from Mountain Pass, California, one of the world's most concentrated areas of REE. The results are an order of magnitude below the values of China's Bayan Obo, but it is reasonable to think those levels can be found within the mineralized zones the Soviets and Afghans described. The light REE values are an order of magnitude below both Mountain Pass and Bayan Obo, but the La versus Yb plot puts our data at the lower end of the Bayan Obo ore trend, which may point to highly fractionated and enriched rocks as the Soviets reported.[11]

In summary, Khanneshin remains highly prospective for rare earth elements as well as other minerals and will require additional work to measure the mineralized zone's size and grade for potential investors. From a USGS field report:

> "We recognize significant potential for economic REE mineralization in the Khanneshin massif. In one day's fieldwork, the minerals scoping team collected several hand-specimens indicative of REE enrichment, and many of these have trace-element and REE concentrations approaching ore grade (tenths of percent). Whereas none of our samples are near the enrichment level of, for example, the world-class Sulphide Queen carbonatite, Mountain Pass CA (Castor 2008), the coarse-grained carbonatites (sövite and pegmatites) from Khanneshin approach this grade to within a factor of 5-7. Our most enriched samples have concentrations of the light rare-earth elements (Ce, Nd, Sm and Eu) at a few tenths of percent. We hope that another mission to the REE prospect will be undertaken to evaluate more completely the potential of this strategically important reserve. [12]

Iron

Afghanistan is well known to possess tremendous iron resources in both sedimentary and igneous rocks. USGS estimates that there are 85 undeveloped sites, including the largest, Haji Gak.

Haji Gak

In addition to being unusual for its size, Haji Gak is also an unusual deposit type, with many questions still unanswered about how it was formed. The Haji Gak deposit is much larger than the area currently being opened for tender, which means that multiple mines could exist in a mining district, all working off of the same deposit.

[11] USGS Administrative Report to TFBSO
[12] Field Notes from 2010 Assessment Report

Sedimentary iron deposits are abundant in central Afghanistan and the Haji Gak iron deposit (approximately 2,100 million tonnes of ore at between 63 and 69 weight percent iron) is of world-class size, large enough to support a major mining operation. Additional resources in a number of sedimentary deposits near Haji Gak bring the total resource for Afghanistan to about 2,260 million tonnes of iron ore with grades higher than 62 weight percent iron.

In 1967 and 1975, Afghan, Russian, French, and German engineers performed feasibility studies that involved extensive drilling and sampling at the site. This work led to Haji Gak becoming the best-known iron oxide deposit in Afghanistan. Occurrences of similar type are found along a 600 km belt leading east and west from the deposit, indicating the deposit could be even larger than currently known.

Haji Gak is more than 32km long with 16 distinct zones reaching up to 5 km in length and 380 meters wide. Several but not all of these zones have received detailed study, and the Soviet work has resulted in a reserve estimate of 1,700 billion tonnes. The ore at Haji Gak is both primary and oxidized, with the primary ore being 80 percent of the deposit's volume but at lower grades than the oxidized ore. The higher-grade oxidized ore is estimated to be 85 million tonnes out of the 1,700 billion tonnes total.

In November 2009, a Task Force scoping team visited Haji Gak to collect samples and gather field impressions at two sites: Surkhi-Parsa and Haji Gak proper. At Surkhi-Parsa the team did not find any signs of mineralization or alteration and did not see any significant economic potential at that locality.

In contrast, the visit to Haji Gak proper was to the mass of magnetite that makes up much of the deposit. The team observed the magnetite contact with the limestone, with observations leading the team to propose "the iron formation was emplaced (tectonically) at rather low-temperature and at a relatively young age (younger than Carboniferous) if Russian age assignments are correct."[13] These field observations as well as sample assay results confirm that the magnetite portion of Haji Gak is extensive and of high-quality iron ready for development. There is also sufficient water to support significant mining activities at the site.

Lithium

As part of the scoping mission, the Task Force met with exploration experts in various commodities, including the team responsible for discovering significant lithium resources in Chile and Bolivia. These experts suggested that many of the evaporite lakes in Afghanistan appear to be similar in nature to those known to produce lithium in other countries. The Task Force engaged this team to utilize remote sensing techniques to analyze which lakes in Afghanistan would be most prospective and to conduct three sampling missions in increasing detail at prioritized locations.

Evidence suggests that previous exploration resulted in discovery of lithium or boron in Afghanistan. The Abi-i-Estada Lake in Ghazni Province reportedly had greater than 1 percent boron in the lake's clays, and Namaskar-e-Herat in Herat Province also had high levels of both lithium and boron reported in its lake brines and salt beds.

[13] USGS Field Trip Notes

In the fall of 2009, the lithium team participated in the scoping mission and collected samples as a test case at Dasht-e-Nawar Lake in Ghazni Province. These samples were analyzed and found to be positive even though the team was not able to reach the preferred locations on the lake due to weather issues. Moreover, samples from an area of the lake anticipated to provide the weakest results yielded average to anomalous values for both boron and lithium.

In addition, the team was able to confirm that no minerals that could possibly give false spectral readings for boron were found at Dasht-e-Nawar. This was crucial, as it allowed the team to conduct more extensive remote sensing analysis on additional lakes with the assurance that false signatures would not create false anomalies in the data. As such, any anomalies or “hot zones” in the data were proposed for further ground sampling for verification and assay.

Following the 2009 scoping mission, the lithium team performed remote sensing analysis on nine evaporite lakes in Afghanistan and identified five as being prospective for lithium.

In the summer of 2010, the lithium team visited those five lakes and collected samples. The lakes visited were:

1. Dasht-e-Nawar
2. Namaskar-e-Herat
3. Chankansar
4. Godzarah West
5. Godzarah East

With ISAF support, the Task Force team collected core samples five feet in depth at multiple locations on each lake. At that depth, the team was able to collect samples from the surface and shallow subsurface which were expected to generate results lower than those you would see at a depth greater than ten meters. Brines, such as those that contain lithium, are often diluted at the surface and saturated at a lower depth. This pattern is seen in most salars that are actively producing lithium in South America.

Assay results on samples from all five lakes showed anomalous concentrations of both boron and lithium. This rate of success was considered highly unusual by the lithium exploration team, and increases the likelihood that even those lakes not yet sampled may be highly prospective.

At several of the lakes the team also saw clear evidence associated with warm hydrothermal waters. In addition, all lakes except Namaskar-e-Herat are close to active or recently active volcanoes. Both of these facts are significant because they indicate that other smaller lakes that fall in that same volcanic and hydrothermally active zone could also be economic at an artisanal scale.

Average values of all samples taken at each salar are given below, with a comparison to the average amount in the earth’s crust and values that the team considers anomalous in red font:

Lake	ICP40 – all in ppm						
	B	**Na**	**Nb**	**Li**	**Th**	**Sr**	**Mg**
Chankansar		1.54	53	49	14	560	1.75
Dasht-e-Nawar	110	10,5460	18	99	11	894	86,917
Godzareh West	87	359,636	43	25	11	568	28,483
Godzareh East	110	251,670	44	36	14	358	16,875
Namaskar-e-Herat	48	302,989	46	41	16	461	8,560
Crustal Abundance	9	22,700	20	18	8.1	384	27,640

Table 7. ICP40 Results of Evaporite Lake Samples Compared to Crustal Abundance

Based on the anomalous results found in the missions during the summer of 2010, the team identified mobile drilling technology that would allow for brine and mineral sample collection at below 10 m – what is anticipated to be the "mixing zone" below which the brines are saturated in lithium.

The team recently returned to Namaskar-e-Herat and drilled below the anticipated mixing zone at multiple locations. All field observations on the November 2010 mission strengthen the evidence collected in previous missions. The team believes samples were collected in the halite zone—a key indicator of correct sample location—and found signs of hydrothermal activity at the sites.

At the Namaskar-e-Herat salar all of the critical diagnostic conditions and all of the significant indicators necessary for a deposit are present. The salar ranks 100% on the numerical model developed by the Task Force team and predict a high probability, above 90%, that Namaskar-e-Herat is an economic grade evaporite deposit.

The Task Force team continues to revise the model and gather additional data to help in the evaluation. The salar has all of the attributes of known economically viable lithium brine mineral deposits and all of the observed characteristics at Namaskar-e-Herat, including the current range of lithium grades, are found at known economic lithium deposits. The Namaskar-e-Herat data strongly matches published information on the lithium brine deposit at Clayton Valley, Nevada, which once produced 30 percent of the U.S. requirements for lithium.

The Task Force has applied the same resource estimate model to all lakes that have been sampled, and all measure at 94 to 100 percent ranking factor, indicating they meet all (or almost all) criteria for an economic deposit when compared to other deposits producing lithium around the world. The ranking model was then applied to world production statistics in order to estimate potential lithium production at each of the lakes, as seen below:

MAJOR Li DEPOSITS	RESOURCE (tonnes Li)	HISTORIC PRODUCTION (tonnes Li/yr)
Silver Peak, Nevada	300,000	9,000
Salar de Hombre Muerto, Argentina	794,786	
Salar de Rincon, Argentina	1,100,000	
Zabuye, China (Total)	1,711,000	7,500
Qaidam Basin, China - Total	2,020,000	20,000
Salar de Atacama, Chile	6,300,000	65,000
Salar de Uyuni, Bolivia	10,200,000	

AFGHANISTAN EVAPORITE DEPOSIT	AFGHAN Li RESOURCE ESTIMATE (tonnes Li)			POTENTIAL LI PRODUCTION (tonnes/year) ¹
Farah	12,639	54,527	112,222	
Abe-e-Istada	14,041	60,575	124,668	
Godzareh Central	22,980	99,140	204,040	9,000
Namaskar-e-Heart	31,023	133,839	275,454	9,000
Godzareh West	45,960	198,280	408,080	9,000
Dasht-e-Nawar	56,163	242,298	498,674	9,000
Chankansar	71,238	307,334	632,524	
Godzareh East	97,665	421,345	867,170	9,000
AFGHAN TOTAL	351,709	1,517,339	3,122,832	45,000

Note 1: Based upon Silver Peak, Nevada which has the lowest brine grade lithium brine deposit successfully operated, roughly 1/3 the evaporation rate of the Afghan Salars and operated continuously for decades with less than 40,000 tonnes of defined resource.

Table 8. Major World Lithium Deposit Production Compared to Afghanistan's Potential Lithium Production

Using these calculations of potential production, the Task Force team has estimated the potential value of each resource and its contribution to Afghanistan's annual GDP. The table below

presents those estimates, with an estimated potential value of over $60.5 billion for all lakes and an estimated annual GDP contribution of $1.2 billion:

AFGHANISTAN EVAPORITE DEPOSIT	POTENTIAL LI PRODUCTION (tonnes/year) [1]	POTENTIAL VALUE OF EVAPORITE PRODUCTION TO ANNUAL GDP OF AFGHANISTAN ($)	POTENTIAL VALUE OF EVAPORITE RESOURCE OVER LIFE OF DEPOSIT TO AFGHANISTAN ($)
Farah			
Abe-e-Istada			
Godzareh Central	9,000	$ 242,160,000	$ 5,490,036,267
Namaskar-e-Heart	9,000	$ 242,160,000	$ 7,411,548,960
Godzareh West	9,000	$ 242,160,000	$ 10,980,072,533
Dasht-e-Nawar	9,000	$ 242,160,000	$ 13,417,648,636
Chankansar			
Godzareh East	9,000	$ 242,160,000	$ 23,332,654,133
AFGHAN TOTAL	***45,000***	***$ 1,210,800,000***	***$ 60,631,960,529***

Table 9. Potential Value of Afghanistan's Evaporite Resources

All reports on the lithium missions are available through the Task Force. The team reports describe in detail the field conditions and assay results for each lake and the rationale behind the chosen technologies and methodologies.

Coal

Balkhab

In order for Balkhab to be effectively developed, the co-located coal is known to surround the deposit must be better understood. Until now, the only information on coal in the Balkhab area is the location of two prospects – Balkhab East and Balkhab West. Details on these two prospects can be found the report "Coal Resources in Balkhab AOI – Remote Sensing Reconnaissance," (Sabins and Ellis, 2010).

In these two areas, the coal seams are thin (~2 m thick), making them challenging to identify and map using satellite remote sensing technology. However, by employing high-resolution images and a different method of viewing the data, the Task Force coal team mapped the extent of the Balkhab coal areas, outlined individual coal seams and any associated mines, and outlined any areas where coal was burned (oxidized). Additional fieldwork is required to estimate coal reserves.

The team used processed and interpreted Landsat satellite digital images which record six spectral bands with 30 m spatial resolution (Sabins, 1997). Using these images combined with IKONOS 75 cm resolution images in natural color, the coal seams could be mapped and outlined. Even with IKONOS imagery, it is difficult to recognize the thin (~2 m) coal seams that are seen as outcrops on steep ledges that have been weathered by water or weather. The team overcame this by draping the images on digital elevation models (DEMs) on Google Earth, allowing views of the images from geographic directions and vertical angles that illuminate where the coal seams are laid out in three dimensions. Examples of these images are found below and many additional products are found in the full report (Sabins and Ellis, 2010).

Also shown on these images are locations mined by the local people in small artisanal mines for fuel along with the access trails used to haul out the coal. One larger operation was found where a surface “long-wall mine” (540 km long) has recently been opened. The team can tell it is recently opened or suspended by the lack of a local soil dump.

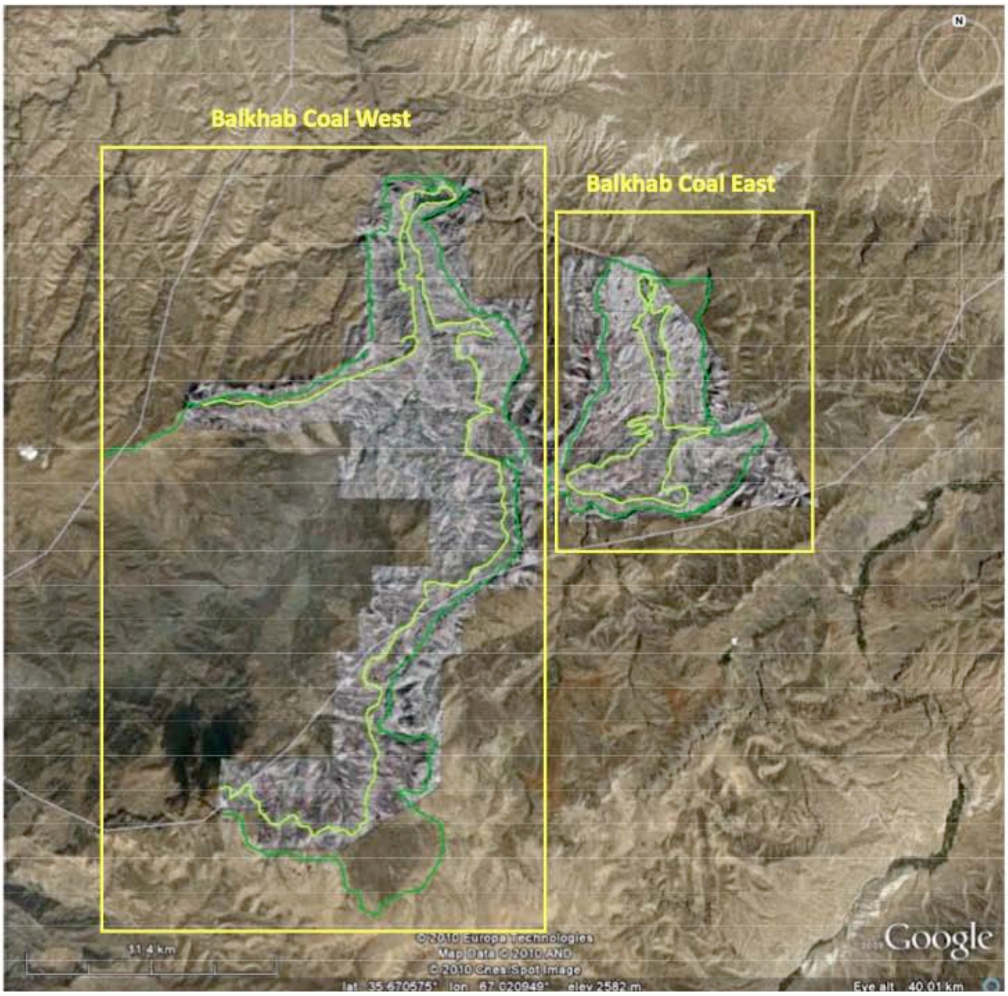


Figure 14: Northeast portion of Balkhab AOI showing location of Balkhab Coal East and West with IKONOS images. Dark green line is the top of coal measures, light green line is the base of coal measures.

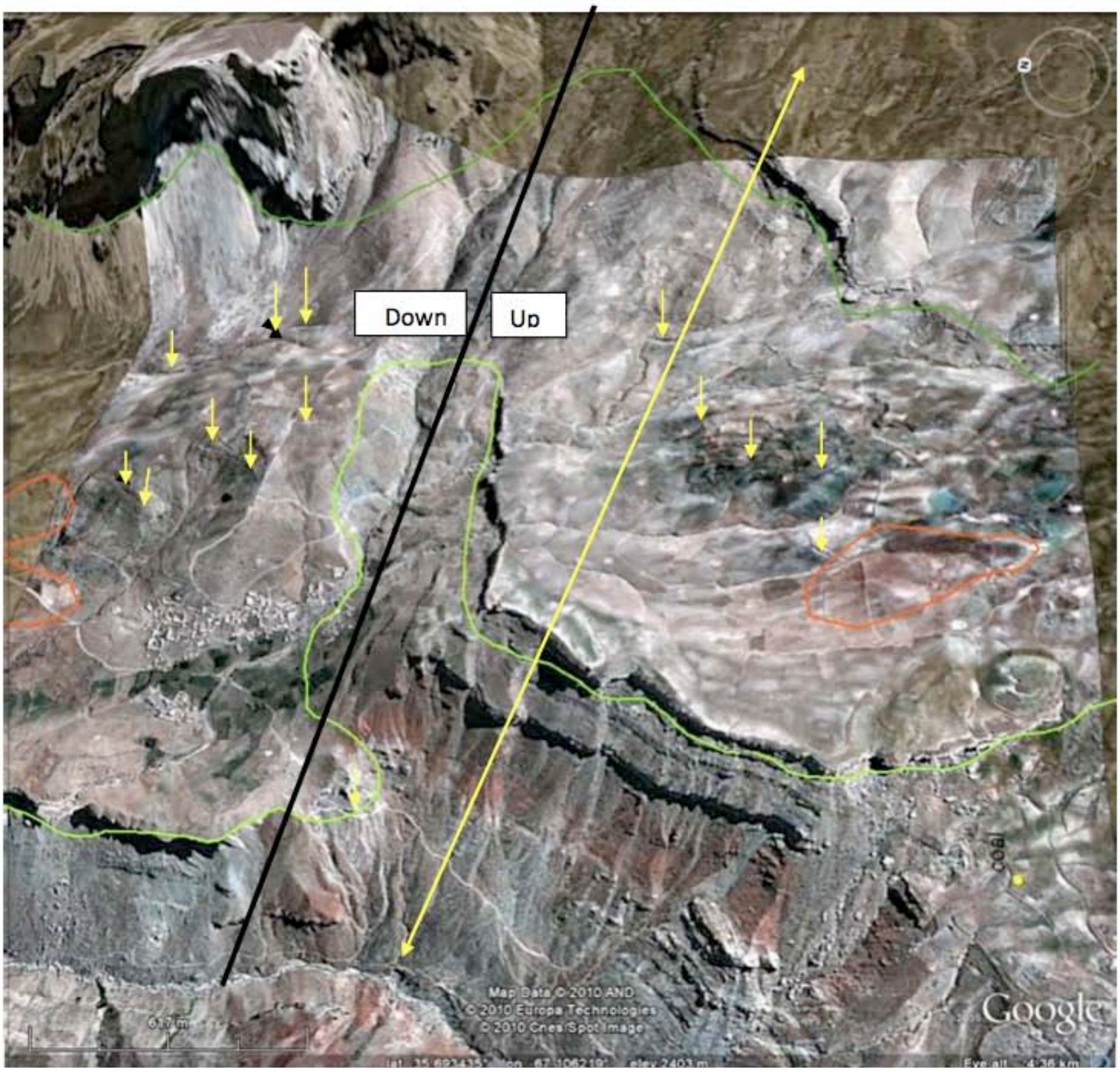


Figure 15: Balkhab East Coal Subarea 3, looking east. Dark green line– Top of coal measures. Light green line – Base of coal measures. Orange outline – Burned coal. Yellow arrows - Coal beds. The dark areas near left and right margins contain numerous coal seams. The south (right) block is upthrown along an east-striking normal fault (heavy black line). Stratigraphy of pre-coal beds is well-exposed. Double yellow arrow is locality of Balkhab stratigraphic section (Figure 1- 4). Note slump block in center of lower margin.

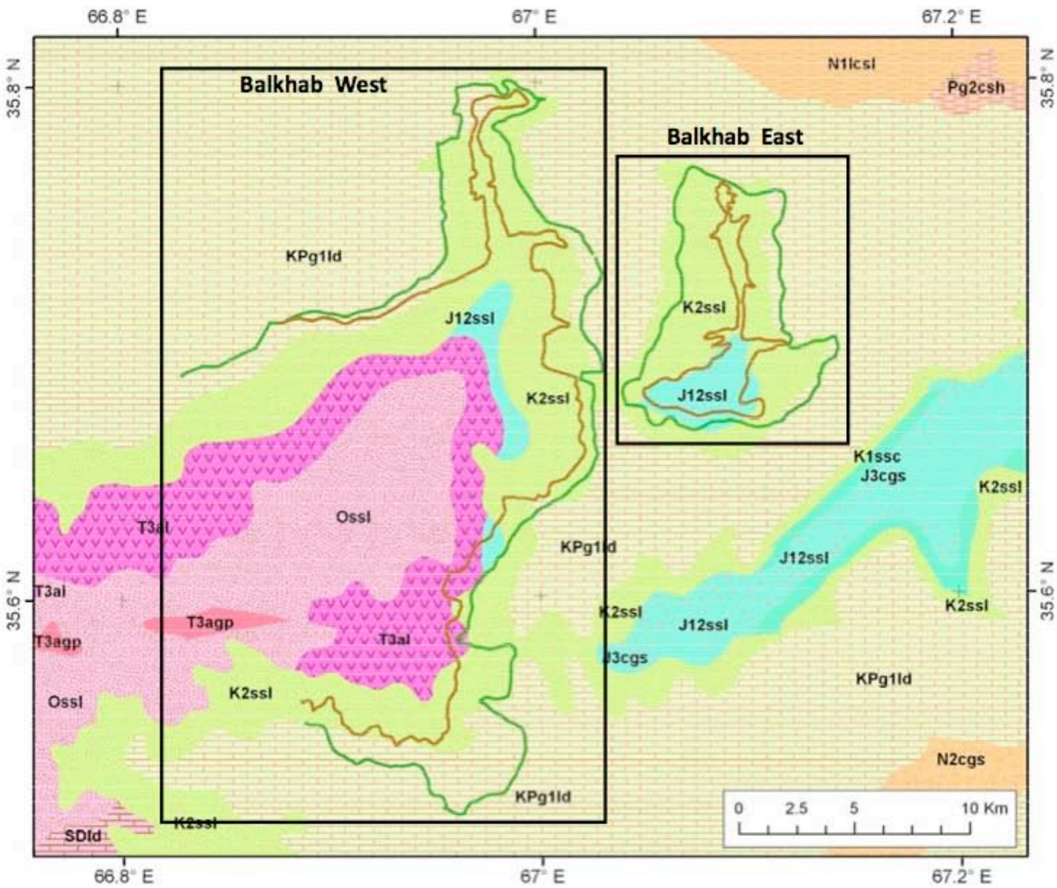


Figure 16: Geologic map of Balkhab East and Balkhab West coal measures. Dark green line – Top coal measures. Brown line – Base coal measures.

- KPg1ld – Late Cretaceous/Paleocene
- K2ssl – Late Cretaceous
- J12ssl – Early-Middle Jurassic
- T3al – Late Triassic-Rhaetian
- Ossl - Ordovician

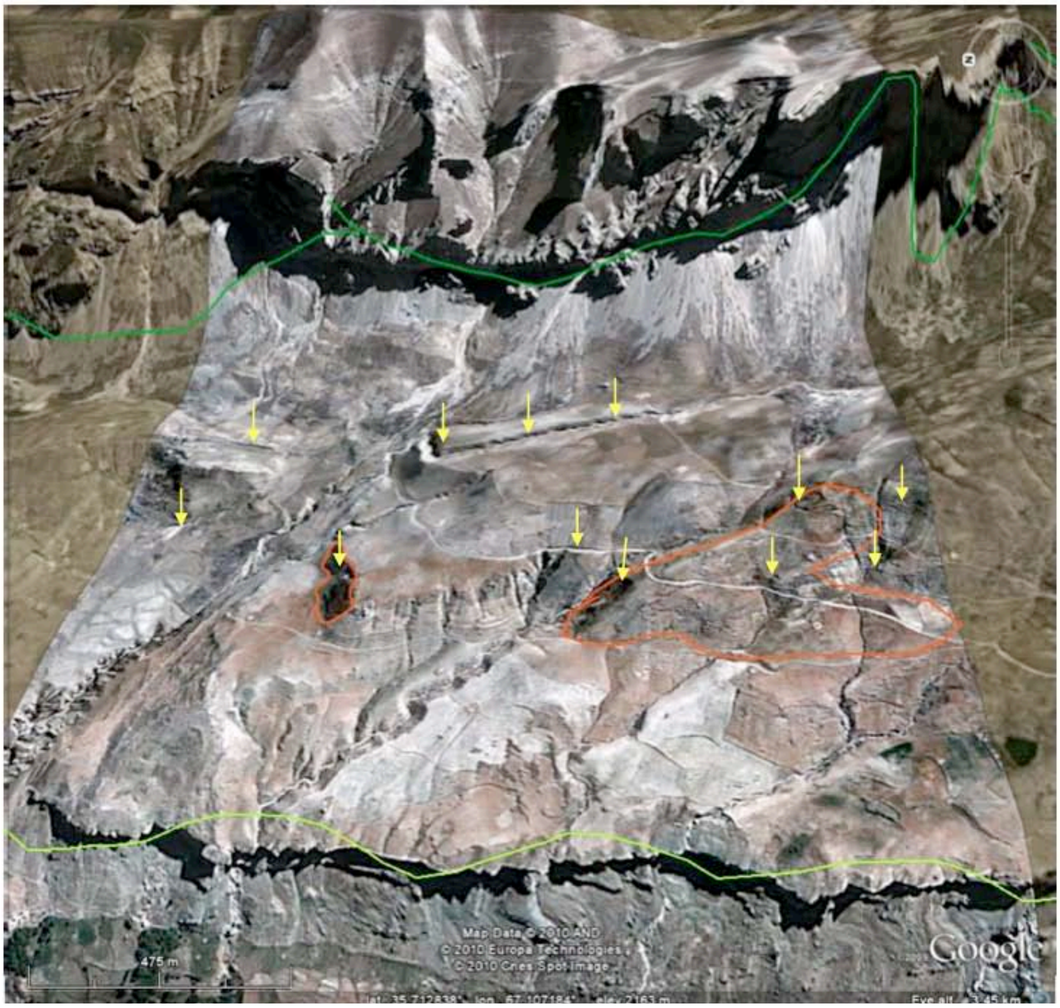


Figure 17: Balkhab East Coal Subarea 4, looking east. Dark green line – Top of coal measures. Light green line – Base of coal measures. Orange outlines – Burned coal. Yellow arrows – Coal beds. The "long wall" mine in top center (three yellow arrows) is 540 meters long and is the largest coal operation in the region. The lack of a large spoil pile suggests an early stage of development, or that development has halted.